PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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Non-destructive testing
Industrial radiography
Corrosion
Electrical and magnetic measurements and instruments
Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page* 3 *of cover*

016 : 526 = 4 *see Abstr.* 2689

MATHEMATICS 51

512.972 : 621–526 2644

Tensorial analysis of control systems. KRON, G. *J. Appl. Mech.*, **15**, 107–24 (*June*, 1948).—[Abstr. 2085 B (1948)].

512.99 : 621.3.012 = 396 2645

On vector diagrams, particularly of second order. BERRE, E. *Elektrotek. Tidsskr.*, **61**, 189–94 (*May* 25, 1948) *In Norwegian.*—[Abstr. 2092 B (1948)].

517.5 2646

Expansions in terms of sets of functions with complex eigenvalues. PEIERLS, R. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 2) 242–50 (1948).

517.522.3 : 548.735 = 82 *see Abstr.* 3010

517.6 = 4 2647

On the functions $K_n(x) = \int_1^\infty \frac{e^{-xt}}{t^n} dt$ and certain related integrals. 1. General properties of $K_n(x)$ and calculation of $I_{psn}(a) = \int_0^\infty e^{-px} x^s K_n(ax) dx$. KOURGANOFF, V. *Ann. Astrophys.*, **10** (*No.* 3) 282–97 (1947) *In French.*

517.6 : 621.392.52 2648

A note on Duhamel's integral, with particular reference to the transient response of cascaded filter sections. TUCKER, D. G. *Phil. Mag.*, **39**, 203–12 (*March*, 1948).—[Abstr. 2241 B (1948)].

517.6 : 621.396.67 2649

The Fourier transform of the incomplete Gaussian function. MILLINGTON, G. *Marconi Rev.*, **11**, 17–30 (*Jan.–March*); 45–50 (*April–June*, 1948).—[Abstr. 2286 B (1948)].

517.9 2650

On perturbation problems associated with finite boundaries. WASSERMAN, G. D. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 2) 251–62 (1948).

517.9 : 530.14 = 4 2651

Perturbations with a change in the boundary conditions. CABRERA, N. *Cah. de Phys.* (*Nos* 31–2) 24–62 (*Jan.*, 1948) *In French.*—A perturbation method of solving partial differential equations with involved boundary conditions is given which depends on a choice of suitable co-ordinates in which the unperturbed equation is separable. This and other methods discussed express the required solution in terms of a series formed from solutions of a problem with simpler boundary conditions. Although less general than other methods, it is claimed that it avoids convergence difficulties attributable to singularities of the series on the perturbed boundary. The method is applied to find solutions of the equations $\nabla^2\psi + \kappa^2\psi = 0$ with a 2-dimensional elliptic boundary. G. J. K.

517.947.44 : 534.01 = 4 2652

Construction of non-linear sinusoidal oscillators by the method of the moving axis. ABELÉ, J. *C.R. Acad. Sci., Paris*, **225**, 1270–1 (*Dec.* 22, 1947) *In French.*—A linear oscillator is represented by the projection on to a vertical axis of a vector turning in space about a fixed origin. A second vector whose end point describes a logarithmic spiral moves about the same axis subject to a condition existing between its amplitude and its phase. From this condition it follows that the projection of this vector on to the vertical axis coincides asymptotically with that of the linear oscillator, while it itself represents the motion of a non-linear sinusoidal oscillator. G. G.

517.948.32 : 621.317.35 : 518.6 = 3 *see Abstr.* 2654

518.5 = 3 2653

Mechanical integration of differential equations. HEINHOLD, J. *Z. InstrumKde*, **63**, 71–4 (*Feb.*, 1943) *In German.*—The machine described employs a sphere and 6 sharp-edged rollers to keep it in position. The theory of this integrating drive is explained in detail. By using a number of these spheres and rollers, complicated differential equations can be solved. V. W. R.

518.5 : 548.735.44 *see Abstr.* 3017

518.6 : 517.948.32 : 621.317.35 = 3 2654

A scanning method for representation of transients and of non-linear distortion. MEYER-EPPLER, W. *Arch. elekt. Übertragung*, **2**, 1–14 (*Jan.*, 1948) *In German.*—[Abstr. 2162 B (1948)].

519.2 2655

Distribution of the sum of randomly phased components. BENNETT, W. R. *Quart. Appl. Math.*, **5**, 385–93 (*Jan.*, 1948).—For the problem see Abstr. 805 (1948). The probability distribution function is expressed as a Fourier–Bessel series, which is useful for numerical work in a region where the asymptotic formula is unsuitable. Application is made to the distribution function for the envelope of a group of sine waves of random phase. L. S. G.

519.24 : 539.163.1 = 4 *see Abstr.* 2915

519.24 : 658.8.03 : 621.316.1 = 3 2656

Mathematical statistics and tariffs. I–II. MOREL, C. *Bull. Ass. Suisse Élect.*, **38**, 141–9 (*March* 22, 1947); **39**, 161–74 (*March* 20, 1948) *In German.*—[Abstr. 2139 B (1948)].

519.283 : 621.38 2657

Statistical methods in the design and development of electronic systems. SCHWARTZ, L. S. *Proc. Inst. Radio Engrs, N.Y.*, **36**, 664–70 (*May*, 1948).—[Abstr. 2210 B (1948)].

ASTRONOMY . ASTROPHYSICS . GEODESY 52

521.042 : 523.112 : 539.17 *see Abstr.* 2933

521.042 : 539.154.2 = 4 *see Abstr.* 2905

522.59 : 535.315 = 3 2658

A simple prism arrangement for image-doubling (double-image direction indicator). GUDZENT, D. *Z. InstrumKde*, **63**, 314–16 (*Sept.*, 1943) *In German.*—For the orientation of telescopes for astronomical photographs by a selected reference star, a prism arrangement is used which doubles the image, the two pictures coinciding only when the telescope is in direct line with the reference star. The author describes a simplified arrangement of 4 prisms which achieves the required image doubling in a simpler way than previous arrangements. V. W. R.

522.615 : 535.568.1 = 4 2659

A photo-electric polarimeter. LYOT, B. *C.R. Acad. Sci., Paris*, **226**, 25–8 (*Jan.* 5, 1948) *In French.*—This note describes the changes which have taken place, and the advances in sensitivity, in the observation of the light from celestial bodies since 1922. The advent of the electron multiplier in 1946 is a further potent instrument for this particular line of study. E. G. M.

522.615 : 535.568.1 = 4 2660

An integrating photo-electric polarimeter utilizing an electron multiplier. LYOT, B. *C.R. Acad. Sci., Paris*, **226**, 137–40 (*Jan.* 12, 1948) *In French.*—Gives many details of the electron multiplier as adapted to the analysis of polarized light. The results are from laboratory tests, and indicate a great increase in efficiency for astronomical work [see Abstr. 2659 (1948)]. E. G. M.

522.617.1 : 523.821.4 = 4 *see Abstr.* 2671

523.11 : 53.081.6 : 530.12 *see Abstr.* 2693

523.112 : 521.042 : 539.17 *see Abstr.* 2933

523.5 : 621.396.821 2661

Meteor whistles. GRIFFITHS, H. V., MARTINGELL, S. E., AND BAYLIFF, R. W. Letter in *Nature, Lond.*, **161**, 478–9 (*March* 12, 1948).—[Abstr. 2301 B (1948)].

523.72 = 4 2662

Solar radiation in the ultra-short radio region. DENISSE, J. F. *Ann. Astrophys.*, **10** (*No.* 1) 1–13 (1947) *In French.*—Electrons of the solar atmosphere in motion in the magnetic field of a rapidly developing sunspot can give rise to electromagnetic radiation in the radio region. If this radiation is to emerge, a large variation in field strength must occur within a critical depth which is ~ 10 km for a field strength of 100 gauss in the lower corona. The lowest layers of the corona give the strongest emission and relatively little absorption. The radiation reaching the earth should be partially circularly polarized (the sense depending on the polarity of the associated spot) and should reach 10^{-17} W/cm² Mc/s at a wavelength of 1 m. Radiation should be observed between a few tens of cm and a few m, in good agreeement with observation. A. HU.

523.72 : 621.396.82.029.63 2663

Solar noise observations on 10·7 centimeters. COVINGTON, A. E. *Proc. Inst. Radio Engrs, N.Y.*, **36**, 454–7 (*April*, 1948).—Daily observations of the 10·7-cm solar radiation show a 27-day recurrent peak which has a strong correlation with the appearance of sunspots. In the absence of large spots the equivalent temperature of the sun is $7{\cdot}9 \times 10^4$°K. Sudden bursts of solar noise show a sharp rise lasting one or two minutes and a gradual decline to pre-storm value or to a somewhat higher value. Average burst duration is 10 min. A.

523.72 : 621.396.821 = 3 2664

175 megacycle radiation from the sun. SCHOTT, E. *Phys. Bl.*, **3** (*No.* 5) 159–60 (1947) *In German.*—The author observed an UHF radiation from the sun when using 125 Mc/s apparatus in Skagen (Denmark) during the war, confirming the results described in Abstr. 195 (1947). Interference with the radar receiver was maximum when the direction of the sun coincided with the receiving maximum of the directional aerial. The effect was maximum before and immediately after sunrise and sunset. No effect was observed at midday, and the local weather conditions had no effect. During May–June, 1940, the sun's radiation fluctuated daily. On days with strong sun radiation the amplitude of landmark radar echoes was also increased up to 10×; echoes up to 250 km distant having been recorded. The effect is thought due to circularly polarized or unpolarized sun radiation over a considerable frequency range. V. W. R.

523.74 : 534.222.2 = 4 2665

Shock waves in the solar atmosphere. HOUTGAST, J. *C.R. Acad. Sci., Paris*, **226**, 392–3 (*Feb.* 2, 1948) *In French.*—The possibility of the propagation of shock waves in the sun's atmosphere is discussed. The author shows that such a mechanism may explain qualitatively the high temperature of the corona and some prominence phenomena. A. B.

523.74 : 621.396.61 : 538.566.2 : 537.521 *see Abstr.* 2846

523.746 = 4 2666

The prediction of sunspots. MAYOT, M. *Ann. Astrophys.*, **10** (*No.* 3) 222–36 (1947) *In French.*—On the basis of Waldmeier's publication of the monthly Wolf-numbers for the solar activity from 1749 to 1944, analytical expressions for the variation are developed. Comparison of the observed values with those predicted 1 and 2 years in advance (using the interval 1844–1944) shows agreement with an absolute mean error of 10–15%. A. B.

523.75 2667

The effect of non-grayness on the temperature distribution of the solar atmosphere. MUNCH, G. *Astrophys. J.*, **107**, 265–8 (*March*, 1948).—A second approximation to the temperature distribution in a model atmosphere [Abstr. 8 (1948)] is obtained. The effect of non-greyness is found to be small, but it is suggested that the boundary temperature of the sun is lower than the grey atmospheric value. R. A. N.

523.75 = 3 2668

On the ionization mechanism in the solar corona. BIERMANN, L. Letter in *Naturwiss.*, **34** (*No.* 3) 87–8 (1947) *In German.*—A new formula is given for the ionization of the corona and chromosphere, assuming that it is maintained by mechanical energy. A. B.

523.77 : 539.133 = 4 2669

Determination of the excitation temperature and the abundance of the molecules CN, CH, C_2, NH and OH by analysis of the Fraunhofer spectrum. HUNAERTS, J. *Ann. Astrophys.*, **10** (*No.* 3) 237–56 (1947) *In French.*—A molecular curve of growth for CN, CH and C_2 is formed, based on equivalent widths measured on the tracings of the Photometric Atlas of the Solar Spectrum, and extended to NH and OH by converting Rowland intensities to equivalent widths. The deduced excitation temperature of $\sim 4\,500°$ agrees with that from atomic data. Molecular abundances are computed, using the theoretical *f*-values of Lyddane, Rogers and Roach. D. L. E.

523.82 : 523.87 = 4 *see Abstr.* 2678

523.821.3 = 4 2670

Photographic photometry of bright stars. II. DE VAUCOULEURS, G. *Ann. Astrophys.*, **10** (*No.* 2) 107–40 (1947) *In French.*—Describes extrafocal photometry on 76 bright stars between 1·5 and 4·5 magnitudes carried out at Houga in 1942. Comparisons with other catalogues are given, confirming the small probable error of the results. Observations on Polaris, Algol and Gamma Cass. are also given, with comparisons of the light curves by other observers. E. G. M.

523.821.4 : 522.617.1 = 4 2671

Stellar photometry by areas. DUFAY, J. *Ann. Astrophys.*, **10** (*No.* 1) 67–79 (1947) *In French.*—Describes a photometer used visually whereby the eye views the illuminated area of the object glass, together with a comparison area with variable illumination. Tests on stars and on laboratory sources show that the precision

obtained is in each case similar. The best conditions and limiting magnitudes reached are discussed. E. G. M.

523.832 = 4 2672

Research on the measurement of radial velocity with the objective prism. I. The absorption method. FEHRENBACH, C. *Ann. Astrophys.*, **10** (*No.* 3) 257–81 (1947) *In French.*—A theoretical paper examining the suitability of the objective prism for radial velocity work on stars, to obtain results for much fainter stars than those which can be observed by the slit method. The errors due to distortion of the field, variation of dispersion, etc., are discussed. Experiments using a solution of Nd chloride of varying strength as a zero of wavelength are described and the structure and variation of the line at 4 273 Å are shown. E. G. M.

523.841 = 4 2673

Observations of red variable stars by the electronic telescope. LENOUVEL, F. *C.R. Acad. Sci., Paris*, **226**, 320–2 (*Jan.* 26, 1948) *In French.*—Stars of spectral type *M* and *N* were observed over a region from 0·7 to 1·0 μ and results are shown graphically at both maximum and minimum light phase. The colour index, visual minus infra-red, is large for both types, varying from four to nine magnitudes from *M*3 to *M*8. E. G. M.

523.841.9 : 523.872 2674

The structure of the atmosphere of the *K*-type component of Zeta Aurigae. WILSON, O. C. *Astrophys. J.*, **107**, 126–50 (*March*, 1948).—The atmospheric structure is analysed on the basis of spectrograms obtained at the 1939–40 eclipse. It is concluded that turbulence and excitation temperatures increase with height in the atmosphere. Density gradients are determined and compared with theoretical predictions. Ionization in the atmosphere is also investigated. R. A. N.

523.854.22 = 3 2675

The origin of the short-period Cepheids and other fast-moving stars. LOHMANN, W., AND MICZAIKA, G. *Z. Naturforsch.*, **2a**, 597–603 (*Nov.–Dec.*, 1947) *In German.*—It is denied that these stars, many of which are found in our galaxy, originated in the globular clusters. Allowing for the observed velocity distribution and the time of relaxation, the theoretical number of stars which would have escaped from the clusters until now comes out much too small. As likely origin the star concentrations in the Milky Way centre are suggested. A. B.

523.87 2676

The Schuster problem for an extended atmosphere. UNDERHILL, A. B. *Astrophys. J.*, **107**, 247–64 (*March*, 1948).—Line formation in a spherically symmetric atmosphere is discussed, and results obtained are compared with those for a plane-parallel atmosphere. R. A. N.

523.87 = 4 2677

Lines of [Fe III] in the spectrum of nova Herculis 1934. DUFAY, J., AND BLOCH, M. *Ann. Astrophys.*, **10** (*No.* 1) 29–32 (1947) *In French.*—The analysis by Edlén and Swings of metastable levels of Fe enables the presence of [Fe III] in Nova Herc. (previously considered only probable) to be made certain. Lines of four different multiplets are identified, and the principal lines of [Fe II] are also present. D. L. E.

523.87 : 523.82 = 4 2678

A study of the continuous radiation of certain stars between 3 100 and 4 600 Å. V. New measures of *D* and λ_1. BARBIER, D., CHALONGE, D., AND CANAVAGGIA, R. *Ann. Astrophys.*, **10** (*No.* 3) 195–221 (1947) *In French.*—Measures made in Paris with a slitless spectroscope of the magnitudes (*D*) and positions (λ_1) of the Balmer discontinuities are corrected by comparison with previous similar measures of standard stars made at Jungfraujoch. The results are used to find the relation of spectral type (*S*) to *D* and λ_1 and of absolute magnitude (*M*) to *S* and λ_1. Exceptions to the mainly good correlation between values of *S* and *M* so determined and values found from other sources are discussed, and the great practical value of measures of *D* and λ_1 are indicated. D. L. E.

523.87 : 535.33 = 4 2679

The excitation of forbidden lines in nebulae, novae and aurorae. BARBIER, D. *C.R. Acad. Sci., Paris*, **226**, 390–2 (*Feb.* 2, 1948) *In French.*—Applications are made of formulae relating electron temperatures and intensity ratios of forbidden lines arising from two different metastable levels. Atomic constants involved which are known for O III are determined for other atoms. D. L. E.

523.87 : 535.33 ≐ 4 *see Abstr.* 2770

523.87 : 537.228.5 = 4 2680

The molecular Stark effect and the Rosseland mean. SCHATZMAN, E. *C.R. Acad. Sci., Paris*, **225**, 1060–1 (*Dec.* 1, 1947) *In French.*—In stellar atmospheres the effect of molecular electric fields in destroying the higher energy levels of H atoms, with consequent reduction of the energy of ionization and shift of the series limits towards the red, has an inappreciable effect on the Rosseland mean even when the shift of the Balmer limit is 200 Å. D. L. E.

523.872 : 523.841.9 *see Abstr.* 2674

523.872 : 523.877 2681

Spectrophotometry of the *F* stars and of τ Ursae Majoris. I. GREENSTEIN, J. L. *Astrophys. J.*, **107**, 151–87 (*March*, 1948).—Line intensities of 350 lines measured in τ UMa, ρ Pup, θ UMa, α CMi and α Per are tabulated. Curves of growth are constructed and used to derive the apparent abundances of elements for each star; abundances relative to the sun are also determined. R. A. N.

523.877 2682

Scattering in a planetary atmosphere. VAN DE HULST H. C. *Astrophys. J.*, **107**, 220–46 (*March*, 1948).—Isotropic scattering in a finite plane-parallel atmosphere without a ground surface is first considered, and a physical interpretation is given to the functions *X* and *Y* introduced by Chandrasekhar [Abstr. 1414 (1948)]. The solution of this "standard" problem is used to derive that for an atmosphere with a ground surface. R. A. N.

523.877 2683

On the radiative equilibrium of a stellar atmosphere. XXII (*concluded*). CHANDRASEKHAR, S. *Astrophys. J.*, **107**, 188–215 (*March*, 1948).—[See Abstr. 1414 (1948)]. Exact solutions of the problem of diffuse reflection and transmission in a plane-parallel atmosphere of finite optical thickness are obtained for scattering with Rayleigh's phase function, with the phase function $\lambda(1 + x \cos\theta)$, and for Rayleigh scattering with allowance for polarization of the radiation field. R. A. N.

523.877 2684

On the radiative equilibrium of a stellar atmosphere. XXIII. CHANDRASEKHAR, S., AND BREEN, F. H. *Astrophys. J.*, **107**, 216–19 (*March*, 1948).—Continues the tabulation of *H*-functions occurring in the theory of semi-infinite plane-parallel atmospheres. R. A. N.

523.877 = 4 2685

White dwarfs and the evolution of stars. SCHATZMAN, E. *Ann. Astrophys.*, **10** (*No.* 2) 93–100 (1947) *In French.*—It is concluded that white dwarfs may have an origin different from that of the main sequence, since known sources of stellar energy imply the existence of a convective core, and stellar rotation implies a chemical

homogeneity incompatible with the evolution of a main sequence star into a white dwarf. R. A. N.

523.877 = 4 2686

Study on the Russell diagram. SCHATZMAN, E. *Ann. Astrophys.*, **10** (*No.* 2) 101–6 (1947) *In French.*—Sen and Berman's model [Abstr. 2136 (1945)] is used to study purely convective stars; it is concluded that such stars have no physical reality. It is also noted that these stars would occupy a region in the Russell diagram below the main sequence. R. A. N.

523.877 = 4 2687

On the probability of a nuclear reaction. SCHATZMANN, E. *C.R. Acad. Sci., Paris*, **226**, 67–8 (*Jan.* 5, 1948) *In French.*—Suggests that the direct conversion of H to deuterium would be permissible in white dwarfs if the H layer were very thin. The results of calculations made for 40 Erid. *B* and Van Maanen 2 are reported. [See also Abstr. 1386 (1948)]. R. A. N.

523.877 = 4 2688

The chemical composition of stars (hydrogen, helium). PECKER, J. C., AND SCHATZMAN, E. *Ann. Astrophys.*, 1(
(*No.* 3) 181–94 (1947) *In French.*—Schwarzschild'
equations, developed in estimating the He content o
the sun [Abstr. 1400 (1947)], are applied to calculate th
H and He contents of other stars. The method is found
to be applicable to 40 of the 60 stars considered, and
most are found to have appreciable He contents. The
composition of 13 of the remaining stars is determined
under the assumption that energy is supplied by the
destruction of heavy elements. R. A. N

523.877 : 523.872 *see Abstr.* 2681

525.624 : 551.513 = 4 *see Abstr.* 3036

526 : 016 = 4 268

Twenty-five years of the *Bulletin Géodésique*. *Bull
Géod.* (*No.* 4) 100–200 (1947) *In French.*—A classifie
list of the titles of all the articles published in the *Bulleti*
since 1922.

526.918.5 : 778.35 *see Abstr.* 3065

PHYSICS 53

53.081.4 = 3 2690

Conversion of corresponding units by numbered indices. THUN, R. *Z. InstrumKde*, **63**, 383–95 (*Nov.*, 1943) *In German.*—The author divides units into 4 groups, viz. (1) the MKS system, (2) the electromagnetic EMU system, (3) the electrostatic ESU system, (4) practical units amp, kg, meter, sec, Centigrade. By means of a number of tables and a system of numbered reference indices any unit of any one group can be converted quickly into the corresponding unit of another group. The use of the tables and indices is explained in detail by worked examples. V. W. R.

53.081.6 : 523.11 : 530.12 *see Abstr.* 2693

53.087.6 : 621.317.755 2691

Stereoscopic viewing of cathode-ray tube presentations. IAMS, H. A., BURTNER. R. L. AND CHANDLER, C. H. *RCA Rev.*, **9**, 149–58 (*March*, 1948).—[Abstr. 2180 B (1948)].

53.088 = 3 2692

Graphical method for the averaging of repeated measurements. LODE, W. *Z. Ver. dtsch. Ing.* (*VDI*) **90**, 89–90 (*March*, 1948) *In German.*—Errors in a number of repeated measurements are assumed to be distributed according to the Gaussian error function. Special set squares, having the edges graduated inversely proportional to the Gauss error integral, are then used to plot the measurements as points on a sheet of paper. By drawing lines through appropriate points marked with arrows on the set squares, and finding the intersection with a line drawn through the plotted points, the mean value of the measurement and the mean deviation can be read off directly. The method is quicker than calculations and shows up mistaken readings much more readily. V. W. R.

FUNDAMENTALS 530.1

530.12 : 53.081.6 : 523.11 2693

On the change of physical constants. TELLER, E. *Phys. Rev.*, **73**, 801–2 (*April* 1, 1948).—It is shown that geological evidence of the existence of a fairly steady temperature on the earth for the last 500 million years is most easily explained assuming that physical constants are not changing with time. [See also Abstr. 1889 (1938), 2017 (1947)]. G. J. K.

530.12 269

The mass-energy relation. SWANN, W. F. G. *Phys
Rev.*, **74**, 200–5 (*July* 15, 1948).—Relativity serves only to
predict the relation for those portions of the mass and
energy which are dependent upon the velocity. Electro
magnetic theory comes near to providing for the res
mass in terms of ordinary electrostatic energy, but with
the well-known discrepancy amounting to a factor of 4/3
For uncharged particles electromagnetic theory does
nothing. A hypothesis is developed according to which
the whole of the rest mass arises from internal motions
of the particles in a form consistent with the required
behaviour of the particles in respect to the apparent
forces which they exert. The line of thought is analogous
to that of the whole philosophy which sought to see all
potential energy as a manifestation of kinetic energy.
It has, moreover, the advantage of unifying the concepts
of rest energy and kinetic energy in a form which gives
the mass-energy relation a more clear-cut meaning. A

530.12 : 531.51 : 538.3 = 4 269

Electromagnetism and relativity. I–III. MARIANI, J.
Cah. de Phys. (*No.* 28) 23–54 (*Sept.*, 1945) *In French.*—
A unified theory is developed, in which the action of an
electromagnetic field on a particle is represented as a
rotation of its world velocity vector, the field being
expressed in terms of the skew-symmetric part of an
asymmetric affine connection. It is assumed that
uncharged matter possesses a non-Maxwellian charge
distribution proportional to the mass density. The theory
is further developed in *C.R. Acad. Sci., Paris*, **218**, 447–9
585–6 (1944) and is there used to predict magnetic fields
for massive rotating bodies. [See Abstr. 2321 (1948)].
R. A. N

530.12 : 538 = 4 269

**On the relation between the magnetic moment and the
angular momentum of spherical masses.** GIÃO, A
C.R. Acad. Sci., Paris, **225**, 924–6 (*Nov.* 17, 1947) *I
French.*—Earlier work [Abstr. 3046 (1947)] based on
the author's unified field theory is extended. It is shown
that the ratio of the magnetic moment to the angular
momentum of a rotating body is equal to a positive o
negative constant, the constant including a numerical
coefficient whose value is unity in the case of uniform
angular velocity and spherically symmetric density distri
butions. [See also Abstr. 2004, 3026–7 (1948)]. R. A. N

530.14 2697

The theory of neutral particles. Le Couteur, K. J. *Proc. Cambridge Phil. Soc.*, **44** (*Pt* 3) 229–41 (1948).—The solution of the Klein-Gordon equation is discussed, and two possible particle densities are defined. One of these is positive definite, the other is of indefinite sign. Attention is confined to the former, which has many properties similar to the charge density. The operators of emission and absorption of particles are respectively those parts of the wave-function referring to positive and negative frequencies. They create and annihilate particles at undetermined points within a radius of $\sim h/mc$. At any instant the particle densities at points $< h/mc$ apart do not commute. This agrees with considerations of pair production and the uncertainty principle. In the transition to the non-relativistic limit it is shown that the limit of the particle density is a Schrödinger probability density. The theory for spin $\frac{1}{2}$ is briefly discussed. L. S. G.

530.14 = 4 2698

An invariant form for the Dirac equations. Van Bergen, F. *Bull. Acad. Belge Cl. Sci.*, **33**, 638–51 (*Nov.* 8, 1947) *In French.*—Equations are obtained by invariant transformation theory which reduce to those of Dirac in spinor form. The relation of this form to others previously obtained is discussed. G. J. K.

530.14 : 517.9 = 4 *see Abstr.* 2651

530.145 2699

Solutions of Dirac's equations in hypercomplex form. Beck, G. *An. Acad. Brasil Cienc.*, **19** (*No.* 4) 321–32 (1947) *In English.*—The solution with hypercomplex numbers [Abstr. 677 (1946)] is here applied with spherical and cylindrical co-ordinates and the separation carried out in a simple manner. The results are applied to obtain solutions in a Coulomb field and also in a constant magnetic field. G. J. K.

530.145 2700

Note on Peng's treatment of the divergency difficulties in quantized field theories. Touschek, B. *Proc. Cambridge Phil. Soc.*, **44** (*Pt* 3) 301–3 (1948).—It is shown that Peng's method of approximation [Abstr. 2479 (1946)] is impracticable in the case of quadrilinear interaction [Abstr. 1547 (1934)], and that it does not remove the infinite self-energy of a nucleon in interaction with a charged scalar meson field. This may be taken to imply that quadrilinear interactions do not exist. A difficulty of Peng's theory in connection with scalar mesons is pointed out. L. S. G.

530.145 2701

Higher order field equations. Green, A. E. S. Letter in *Phys. Rev.*, **73**, 519 (*March* 1, 1948).—Meson equations with 3rd- and 4th-order derivatives in the Lagrangian are discussed [see Abstr. 1149 (1948)]. Field equations of the 8th order are obtained with 4 mass eigen-values, the nuclear interaction remains finite at small distances, and self-energies are finite. G. J. K.

530.145 2702

A possible new type of spin-spin interaction. Stueckelberg, E. C. G. Letter in *Phys. Rev.*, **73**, 808 (*April* 1, 1948).—To explain difficulties in the hyperfine structure of H and D [Abstr. 2614 (1947)], it is suggested that the spin-spin interaction be modified by introducing a direct interaction of the spin density of the electron with a new field of a Maxwell type. In general relativity the field is that of a torsion of space. G. J. K.

530.145 2703

Resonance reactions involving Dirac-type incident particles. Goertzel, G. *Phys. Rev.*, **73**, 1463–6 (*June* 15, 1948).—An investigation has been made to determine whether the results of Wigner and Eisenbud can be extended to include the scattering of a particle which obeys a Dirac-type wave equation. It is found that no additional difficulties arise as a result of the use of Dirac particles, and that the treatment of Wigner and Eisenbud can be carried through step by step with relatively minor changes. It was necessary, however, to determine the appropriate relativistic boundary conditions to be satisfied by the external and internal wave functions at the boundary of the internal region. It is hoped that a comparison of the relativistic and non-relativistic conditions will lead to a clearer understanding of those in the non-relativistic problem. A.

530.145 2704

A note on perturbation theory. Feenberg, E. *Phys. Rev.*, **74**, 206–8 (*July* 15, 1948).—The perturbation theory for a stationary state is developed in the form of an implicit equation for the eigenvalue and an explicit equation (involving the eigenvalue) for the amplitudes. With the aid of a formal algebraic identity the equation for the eigenvalue is transformed into a semi-explicit form by a procedure having a wider range of validity than the more obvious iteration or power series processes. A.

530.145 = 3 2705

Particle production in a homogeneous electric field varying with time. Blass, G. *Z. Phys.*, **122** (*Nos* 1–4) 163–91 (1944) *In German.*—A change in the electric field over the whole region of another field of particles results not only in a change of their momenta but in the creation of pairs moving in the same and the opposite direction with the same final momenta. In the quantized but not in the classical theory, this occurs also when no particles are initially present. Calculations are made both for scalar and spinor fields, either with a discontinuous or continuous change in time of the vector potential describing the electric field. G. J. K.

530.145 = 3 2706

On a symmetry property of the wave theory of matter. Hund, F. *Z. Phys.*, **118** (*Nos* 7–8) 426–40 (1941) *In German.*—A 5-dimensional representation is obtained simply for the scalar and vector meson field equations and also for the spinor Dirac equations, together with tensors for the energy and momentum densities, charge and current. G. J. K.

530.145 = 4 2707

The proper field and the interaction of Dirac particles. I. Pirenne, J. *Arch. Sci. Phys. Nat.*, **28**, 233–72 (*Nov.–Dec.*, 1946) *In French.*—Classical electrodynamics and the proper field of the electron are discussed. The Maxwell–Lorentz equations are transformed into a form suitable for the development of the solution into a Fourier series. The field is then considered as an ensemble of harmonic oscillators, and the interaction between particles and superposition of their proper fields are studied. The Dirac equations for the electron and positron are discussed, together with the negative energy states. L. S. G.

530.145 = 4 2708

The proper field and the interaction of Dirac particles. II. Pirenne, J. *Arch. Sci. Phys. Nat.*, **29**, 121–50 (*May–June*, 1947) *In French.*—Quantization of the electromagnetic field is discussed and the solutions of the equations of quantum electrodynamics are interpreted. The proper field of the electron is next studied. Transitions between energy states of the same or opposite signs are considered, and the longitudinal and transverse parts of the field are separated out. The proper field of the positron is very briefly discussed. L. S. G.

530.145 : 537.122 = 4 2709

The proper field and the interaction of Dirac particles. III. PIRENNE, J. *Arch. Sci. Phys. Nat.*. **29**, 207–38 (*July–Aug.*, 1947) *In French.*—[See Abstr. 2708 (1948)]. The interaction of two particles is considered. The state of a system of two electrons interacting in an electromagnetic field may be represented by a wave function with 16 components. The interaction terms in the Hamiltonian are discussed and properties of the wave function are developed. The theory of the interaction between an electron and a positron is presented, and the phenomenon of virtual annihilation is discussed. L. S. G.

530.145 = 4 2710

The approximation of geometrical optics in the theory of particles of spin. KWAL, B. *C.R. Acad. Sci., Paris*, **226**, 61–3 (*Jan.* 5, 1948) *In French.*—The Wentzel–Brillouin–Kramers method is applied to the vector meson equations. Zero order gives the classical particle equations of motion. The next approximation is used to obtain a continuity equation for a charge 4-vector. G. J. K.

530.145 = 4 2711

The approximation of geometrical optics in the wave mechanics of elementary particles. PETIAU, G. *C.R. Acad. Sci., Paris*, **226**, 224–6 (*Jan.* 19, 1948) *In French.*—The Wentzel–Brillouin–Kramers method is applied to the meson particle equations [cf. Abstr. 2710 (1948)] and those of particles of any spin described by an earlier theory [Abstr. 2414 (1947)]. G. J. K.

530.145 : 537.122 2712

Classical theory of charged point-particles with dipole moments. LATTES, C. M., SCHÖNBERG, M., AND SCHÜTZER, W. *An. Acad. Brasil Cienc.*, **19** (*No.* 3) 193–245 (1947) *In English.*—Schönberg's theory of the point electron [Abstr. 1624 (1946)] is applied to a point with magnetic and electric dipole moments. A satisfactory stress tensor is obtained, and the equations of motion are derived both by a direct method and by a method due to Frenkel, modified to allow for radiation reaction. Alternative variation procedures are given, and extensions for a system of such particles. The theory is then put into Hamiltonian form. The Poisson brackets of the spin components correspond to the usual quantum values, though differing from those previously given by Kramers. G. J. K.

530.145 : 537.122 = 6 2713

A note on the derivatives of the radiation field of the classical point electron with spin. SCHÜTZER, W., AND TIOMNO, J. *An. Acad. Brasil Cienc.*, **19** (*No.* 4) 333–42 (1947) *In Spanish.*—Application of Schönberg's theory [Abstr. 2712 (1948)].

530.145 : 537.122 2714

Continuous particles. HESSABY, M. *Proc. Nat. Acad. Sci., Wash.*, **33**, 189–94 (*June*, 1947).—A re-interpretation of Maxwell's equations in general relativity leads to the deduction of a metric tensor for the field of an uncharged particle which yields a finite density of energy at every point in space, the integral of the energy over the whole of space being equal to the mass of the particle which thus appears as a continuous distribution of energy through space. An expression is deduced for the electrostatic energy of an electron giving charge and energy densities which are finite at every point in space, the integrals over the whole of space being, respectively, equal to the charge and to the mass of the electron. An indication is found of the possibility of an attraction between two positive charges in a certain range of distances and of an attraction between a positive charge and an uncharged mass. The consideration of a certain solution of the wave equation of Maxwell's theory leads to the notion of a harmonic spherical wave surrounding a particle in motion, which leads to a new interpretation of Schrödinger's wave equation. A.

530.145 : 537.122 2715

Theoretical evidence for the existence of a light-charged particle of mass greater than that of the electron. HESSABY, M. Letter in *Phys. Rev.*, **73**, 1128 (*May* 1, 1948).—It is shown that the author's theory [Abstr. 2713 (1948)] predicts the existence of a particle of 1·444 electron-masses.

530.145 : 537.133 2716

Remarks on H. W. Lewis' paper "On the reactive terms in quantum electrodynamics." EPSTEIN, S. T. Letter in *Phys. Rev.*, **73**, 177 (*Jan.* 15); *errata*, 630 (*March* 15, 1948).—[See Abstr. 1769 (1948)]. W. E. D.

530.145 : 538.1 2717

On the divergences of quantum electrodynamics. LOPES, J. L. *An. Acad. Brasil Cienc.*, **19** (*No.* 1) 51–66 (1947) *In English.*—The electronic self-energy is calculated using Schönberg's theory [Abstr. 1624 (1946)]. The electrostatic self-energy and its dynamic counterpart go out, but the transverse part remains. The effect on these terms of alternate methods of quantizing are considered. G. J. K.

530.145.1 2718

Dirac's one-electron problem in momentum representation. RUBINOWICZ, A. *Phys. Rev.*, **73**, 1330–3 (*June* 1, 1948).—The eigenfunctions are transformed into a form suitable for numerical calculations. A.

530.145.1 2719

Transformation theory applied to a radiation field. BALSEIRO, J. A. *Phys. Rev.*, **73**, 1346–8 (*June* 1, 1948).—A photon distribution is described by a field function in terms of an orthogonal system. The distribution when the field is given in terms of another orthogonal system is found by means of transformation theory. A.

530.145.6 2720

Characteristic values of spheroidal wave functions. EBERLEIN, W. F. *Phys. Rev.*, **74**, 190–1 (*July* 15, 1948).—An asymptotic expansion for the characteristic values of the (prolate) spheroidal wave equation is obtained. The expansion contains the Ince–Goldstein expression for the characteristic values of the Mathieu equation as a special case ($m = -\frac{1}{2}$). A.

530.145.6 = 69 2721

Properties of Heisenberg's characteristic matrix in the one-body problem. SCHÜTZER, W. *An. Acad. Brasil. Cienc.*, **19** (*No.* 4) 283–97 (1947) *In Portuguese.*—The *S*-matrix and the occurrence of redundant zeros are discussed for 5 types of potential, including a new type with a potential hole surrounded by a barrier. G. J. K.

530.145.6 : 531.19 = 4 2722

Some properties of an assembly of possible motions in wave mechanics in terms of a quantum statistical mechanics. MORETTE, C. *Cah. de Phys.* (*Nos* 31–2) 63–74 (*Jan.*, 1948) *In French.*—The problems discussed are the motion in Hilbert space of a given state describing a system, and also the examination and description statistically of the motion of an assembly of states needed for a system whose initial configuration is not completely specified, but subject to uncertainties. G. J. K.

530.145.63 2723

On the application of Heisenberg's theory of *S*-matrix to the problems of resonance scattering and reactions in nuclear physics. HU, N. *Phys. Rev.*, **74**, 131–40 (*July* 15, 1948).—It is shown that the Heisenberg *S*-matrix can have only simple poles and zeros in the complex plane of momentum and energy variables when the range of

force is short. This fact is sufficient to determine the dispersion formulae in nuclear physics. A.

530.145.63 = 4 2724

The characteristic matrix of Heisenberg and the theory of elementary particles. KAHAN, T. *Rev. Sci., Paris*, **85**, 997–1002 (*Oct.*, 1947) *In French.*—A short résumé of recent papers.

530.145.7 2725

Calculation of a perturbing central field of force from the elastic scattering phase shift. HYLLERAAS, E. A. *Phys. Rev.*, **74**, 48–51 (*July* 1, 1948).—It has been shown that the interaction potential between two particles can be uniquely determined from the supposed knowledge of the observed phase shifts for the whole energy range, but for only one particular angular momentum. Coulomb forces between charged particles, as well as all kinds of inelastic scattering, have so far not been considered. A.

530.16 = 3 2726

On the interpretation of quantum mechanics. VON WEIZSÄCKER, C. F. *Z. Phys.*, **118** (*Nos* 7–8) 489–509 (1941) *In German.*—The postulates and interpretation of quantum mechanics, especially its evidence and its relation to causality, are expressed in order to emphasize the philosophical consequences and those features necessarily to be found in any future theory. G. J. K.

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.19 : 530.145.6 = 4 *see Abstr.* 2722

531.19 : 548.7 *see Abstr.* 2988

531.252.2 2727

Large deflection of a circular clamped plate under uniform pressure. CHIEN, W.-Z. *Chin. J. Phys.*, **7**, 102–13 (*Dec.*, 1947).

531.261 : 550.312 *see Abstr.* 3025

531.51 : 538.3 : 530.12 = 4 *see Abstr.* 2695

531.552 = 3 2728

Critical consideration of the processes of S. Dufrénois and O. von Eberhard for the determination of the ballistic air density. ROTH, E., AND SÄNGER, R. *Schweiz. Arch. angew. Wiss. Tech.*, **14**, 22–32 (*Jan.*, 1948) *In German.*—Having set up the fundamental ballistic equations in a suitable form, using the Rothe–Cranz transformations, the author discusses the effect of perturbations on the variables. Two methods of solution, involving assumptions of particular approximations for the ballistic air density are discussed. These are shown to lead to results of the same order of accuracy and to adequate approximations for the changes in both range and time of flight. Results are computed from the theory using various empirical ballistic tables and shown graphically. G. O. B.

531.578 : 539.24 : 539.4.011 *see Abstr.* 2963

531.578 : 539.4.011 *see Abstr.* 2961–2

MECHANICAL MEASUREMENTS 531.7

531.715.27 : 535.8 = 3 2729

The comparator principle and its optical equivalent. RÄNTSCH, K. *Optik*, **2**, 235–42 (*Aug.*, 1947) *In German.*—The comparator principle, that the measured length and measuring scale be a continuation of the same axis, requires a measuring machine to have a length appreciably > the maximum to be measured. It is shown that the principle may be employed effectively without this increased length by using the focal and nodal properties of lenses. Eppenstien's method has been used for machines with a capacity of 6 m. H. H. HOP.

531.718 = 3 2730

Gauge block sets. SCHRÖDER, R. P. *Z. InstrumKde*, **63**, 109–20 (*March*, 1943) *In German.*—Gives the mathematical basis of gauge block sets and their practical graduation. The use and precautions necessary with gauge blocks are discussed. The extension and subdivision of the range covered is explained. The accuracy of combined gauges is investigated, and the replacement and reconditioning of gauge blocks is considered. Special gauge blocks are required for customs and export purposes. V. W. R.

531.719.1 : 539.166 2731

A precision method of generating circular cylindrical surfaces of large radius of curvature for use in the curved-crystal spectrometer. DUMOND, J. W. M., LIND, D. A., AND COHEN, E. R. *Rev. Sci. Instrum.*, **18**, 617–26 (*Sept.*, 1947).—The steel or other block to be ground is attached near the circumference of a wheel (radius R) rolling inside a cylinder of double the radius, at the centre of which is placed a small circular grinding wheel (radius r). Concave surfaces of radius $R + r$, or convex, of radius $R - r$ will be formed, depending on whether the work is fixed outside or inside the circumference. Surfaces 3×5 in with radius of curvature of 79 in have been ground with a precision of $\sim 0{\cdot}0002$ in, and have been used for clamping laminae of crystalline quartz for use in curved crystal focusing γ-ray spectrometer. A.

531.719.33 : 621.317.39 : 621.396.933 2732

Low-reading absolute altimeters. SHARPE, B. A. *J. Instn Elect. Engrs, Pt IIIA* (*No.* 16) 1001–11 (1947).—[Abstr. 2318 B (1948)].

531.756 2733

A specific gravity balance. MAHANTI, P. C., AND BHATTACHARYYA, S. P. *Indian J. Phys.*, **22**, 69–73 (*Feb.*, 1948).—Details of a balance designed to indicate directly up to the 4th decimal place the specific gravity of liquids and solutions are given. The balance is as quick in operation as a common hydrometer used in industrial practice. A.

531.787.1 = 3 2734

Theory of Bourdon-gauge tube movement. WUEST, W. *Z. InstrumKde*, **63**, 416–24 (*Dec.*, 1943) *In German.*—The movement of Bourdon gauge tubes is mathematically investigated and based on the instantaneous centre of rotation. Single-turn, multi-coil and spiral Bourdon gauge types are considered. Experimental measurements are in approximate agreement with the theory. V. W. R.

MECHANICS OF LIQUIDS 532

532.12 : 539.389.3 = 4 *see Abstr.* 2959

532.13 : 537.32 : 536.75 *see Abstr.* 2820

532.517 2735

Stability of the laminar parabolic flow of a viscous fluid between parallel fixed walls. PEKERIS, C. L. *Phys. Rev.*, **74**, 191–9 (*July* 15, 1948).—Asymptotic expressions are derived for the characteristic values C of 2-dimensional disturbances of the parabolic flow in the limit of small wave numbers α and large values of αR, where R denotes Reynolds number. The result shows stability of the first mode at large αR and small α^2. The possible perturbations of the parabolic flow fall into two classes, one in which at $\alpha^2 = 0$, $C_r \to 0$, as $\alpha R \to \infty$, and another in which $C_r \to 1$ as $\alpha R \to \infty$. At large αR, the characteristic values of the modes in the latter class for finite α^2 approach their values at $\alpha^2 = 0$, and are stable. All the modes of the first class are stable at large αR as far as α^2-terms in C are concerned. In the even modes of this class the phase velocity becomes negative (propagation

upstream) for $\alpha^7 R > M$, where M for the second mode has a value of 10 700. The possible bearing of this result on stability experiments is discussed. A.

532.527 : 532.533 2736

Laboratory experiments on whirlpools. BINNIE, A. M., AND HOOKINGS, G. A. *Proc. Roy. Soc. A*, **194** (*No.* 1038) 398–415 (1948).—Two vertical pipes, placed on the axis of an open circular tank and fitted with trumpet entries of different shapes, were used in turn as overflows. Water was led into the tank in such a way that the stream approaching the trumpet under test possessed tangential velocity, which caused a vortex to appear in and above the trumpet. The relations between head and discharge were determined under various conditions of tangential supply. The formation of a vortex greatly reduced the discharge, the decrease being even more marked with the shallow than with the deep trumpet. At low heads, where the flow was controlled by the weir action of the trumpet crest, the discharge varied with the shape of the crest as well as with the irrotational constant c and the head, therefore (as with purely radial supply) it must be determined by experiment. At high heads with the trumpet flooded, the throat controlled the flow; within certain limits, the discharge was dependent chiefly upon c and the head measured with the throat as datum, and an approximate theory which ignores friction was verified. Two types of instability, "surging" at low heads and "spluttering" at high heads, were examined. Both were due to the collapse and subsequent re-formation of feeble vortices, which caused the discharge to vary with time in a periodic manner. A.

532.529.7 2737

The laminar mixing motion of two incompressible gases. CHOU, P. Y. *Chin. J. Phys.*, **7**, 96–101 (*Dec.*, 1947).—Equations determining the velocity and density distributions within the mixing region of the two gases with different densities are set up, their temperatures being the same. For incompressible mixing the total number of gas molecules per unit volume is constant, but the density of the gaseous mixture varies from point to point due to diffusion of matter. The plane jet and steady motion are considered. The boundary layer method of approx. is applied. The boundary of the jet is the same as that for one fluid. The solution of the problem depends upon the numerical value of the coefficient of viscosity of the mixture which is a function of the number of molecules of each constituent gas in the unit volume. The present method of investigation is applicable to the cylindrical and half jets and also to the case where the two gases are at different temperatures. A.

532.533 : 532.527 *see Abstr.* 2736

532.574.3 : 621.317.39 = 3 2738

Flow-meters and flow-telemetering for rotating vane meters. LOHMANN, H. *Siemens-Z.*, **22**, 102–5 (*July–Sept.*, 1942) *In German.*—[Abstr. 2166 B (1948)].

CAPILLARITY 532.6

532.6.08 : 541.183 = 3 2739

A surface pressure balance for monomolecular films. TRURNIT, H. J. *Z. Naturforsch.*, **2a**, 267–74 (*July–Aug.*, 1947) *In German.*—This is a modification of the usual torsion-wire type of surface pressure balance, and is made from the framework and graduated circle of a polarimeter. Its special feature is that it can easily be moved clear of the trough for sweeping the water surface; the float is also easily detachable from the lever system and from the leak-preventing foils at the trough edges. The range extends down to 0·001 dyne cm^{-1}, and the precision, which is 2–3% at 5 dynes cm^{-1}, is higher at lower pressures. Full details for construction are given. S. J. G.

532.62 : 534.212 2740

Transverse waves in plane soap films. SATTERLY, J. *Trans. Roy. Soc. Can.*, **41**, 55–61 (*May*, 1947).—Travelling and stationary, waves were observed in narrow rectangular soap films. The source was a dipper penetrating the film at one end and excited electromagnetically at frequencies of 30 to 400 c/s. Films of various areas were used, and the wave crests were sometimes inclined at angles up to 45° to the length of the film. Waves coming down one arm of an L-shaped film could be reflected down the other arm by a strip of mica. The experiments may have a bearing on the propagation of electromagnetic waves along the surfaces of metals and on the action of wave guides. J. I.

532.65 : 538.082.1 = 4 *see Abstr.* 2880

532.694.1 : 614.845.6 2741

A study of mechanically produced foam for combating petrol fires. CLARK, N. O. *Dep. Sci. Industr. Res. (Chem. Res. Spec. Rep. No.* 6) 113 *pp.* (1947).—A detailed account is given of an investigation of the physical properties of foam and foam-producing agents. Methods were developed for both large-scale testing and for laboratory experiments. Laboratory measurements of the physical properties (e.g. interfacial tension, viscosity, bubble size, expansion and stability) provided a useful guide in predicting the value of a foam in controlling petrol fires though no exact correlation was achieved. Results of a large series of tests are listed for the various agents investigated. The development of some very efficient foam-producing agents is described and their properties classified. Earlier work is summarized and there are 149 references. J. I.

KINETIC THEORY OF LIQUIDS 532.7

532.7 = 3 2742

The structure of ethyl alcohol at low temperatures. JAGODZINSKI, H. *Z. Naturforsch.*, **2a**, 465–72 (*Aug.*, 1947) *In German.*—A procedure for the quantitative evaluation of X-ray patterns of liquids has been developed, and is applied to the recorded distribution functions of ethyl alcohol at −75° (Harvey) and at −150° (Prietzschk). Prominent maxima and minima of the distribution function above 3 Å at −150° appear to be connected with a diminution in the power of free rotation of associated molecules owing to the increased chain length. At −150° there also appears to be a marked tendency for parallel layering of neighbouring molecules. At −75° a dynamic type of association exists in which formation of long chains is unlikely, and the form of scattering is due to two free associated molecules rotating against each other. W. R. A.

532.7 : 537.226 = 3 *see Abstr.* 2831

532.7 : 539.132 = 4 2743

On the attractions between macromolecules in liquids at large distances. WINTER, J. *C.R. Acad. Sci., Paris*, **226**, 704–6 (*March* 1, 1948) *In French.*—The orientation of a liquid in the neighbourhood of a macromolecule is suggested as an indirect cause of this interaction for special positions where their bounding surfaces are in complementary positions. G. J. K.

532.712 = 3 2744

On van't Hoff's theory of the Soret effect (the osmotic pressure in non-isothermal systems). WIRTZ, K. *Z. Phys.*, 118 (*Nos* 7–8) 510–14 (1941) *In German.*—The assumption of van't Hoff that the osmotic pressure is constant in a stationary non-isothermal system leads to wrong values

of the Soret coefficient. It is pointed out that this assumption is not justified. An expression is given by which the dependence of the osmotic pressure on temperature can be calculated from the Soret coefficient. H. L.

532.72 2745

A diffusion problem in which the amount of diffusing substance is finite. III. Diffusion with non-linear adsorption into a composite circular cylinder. CRANK, J., AND GODSON, S. M. *Phil. Mag.*, **38**, 794–801 (*Nov.*, 1947).—The method of a previous paper [Abstr. 1457 (1948)] is used to solve the diffusion problem. It is numerical, and some typical solutions, relating to diffusion of dyes into cylindrical non-homogeneous fibres, are given. The adsorption terms may be linear or non-linear. L. S. G.

532.74 : 535.435 = 3 *see Abstr.* 2804

532.782 : 539.4.015 *see Abstr.* 2964

MECHANICS OF GASES 533

533.56 = 3 2746

On the theory of the diffusion pump. JAECKEL, R. *Z. Naturforsch.*, **2a**, 666–77 (*Nov.–Dec.*, 1947) *In German.*—Following Gaede, the physical processes involved in the operation of a diffusion pump are discussed theoretically. Formulae for the ratio of the backing to the high vacuum pressure, and for the pumping speed, are derived for two models, (*a*) a first approx., in which all the vapour molecules are assumed to move with the same constant speed parallel to the axis of the pump, and (*b*) a second approx., in which they have only a component of their speed in the axis direction, and are also subject to thermal agitation. The formulae were verified experimentally on the large oil diffusion pump of Jaeckel–Schröder [*Z. tech. Phys.*, **24**, 69 (1943)]. S. W.

533.6.011.4 2747

Interferometric studies of faster than sound phenomena. I. The gas flow around various objects in a free, homogeneous, supersonic air stream. LADENBURG, R., WINCKLER, J., AND VAN VOORHIS, C. C. *Phys. Rev.*, **73**, 1359–77 (*June* 1, 1948).—A small Mach–Zehnder interferometer was used for analysis of the air flow in a free homogeneous jet of cylindrical symmetry at Mach number 1·70 and around various simple objects suspended in it. The density, pressure, temperature, velocity and Mach number throughout the air flow were determined. For suspended cones of 10° and 30° semi-angle the theory of Taylor–Maccoll was verified—except near the cone tip where a systematic density increase occurred. The experience obtained with the small interferometer indicates that it is a very valuable instrument in studying supersonic phenomena, and that it will yield accurate quantitative results not obtainable by other methods. A.

533.6.011.5 : 534.222.2 2748

The condition for the detachment of the shock wave from a wedge in a supersonic stream. PACK, D. C. *Proc. Cambridge Phil. Soc.*, **44** (*Pt* 3) 298–300 (1948).—For a given wedge and speed of the incident stream an equation, which gives possible positions of the shock waves, is derived. The critical shock-wave angle is computed, and an error in a paper due to Epstein [Abstr. 301 (1932)] is corrected. L. S. G.

KINETIC THEORY OF GASES 533.7

533.7 = 3 2749

Is there rotational friction? FUES, E. *Z. Phys.*, **118** (*Nos* 7–8) 409–15 (1941) *In German.*—The relation between viscous stress and the local velocity distribution in a gas is discussed for several typical examples using the stress tensor of the kinetic theory. The absence of viscous forces for rigid rotations is especially mentioned. G. J. K.

VIBRATIONS . ACOUSTICS 534

534.01 : 517.947.44 = 4 *see Abstr.* 2652

534.1 : 548.7 *see Abstr.* 2989–98

534.212 : 532.62 *see Abstr.* 2740

534.222.2 : 523.74 = 4 *see Abstr.* 2665

534.222.2 : 533.6.011.5 *see Abstr.* 2748

534.232 : 621.395.623 2750

Underwater sound transducers. OLSON, H. F., HACKLEY, R. A., MORGAN, A. R., AND PRESTON, J. *RCA Rev.*, **8**, 698–718 (*Dec.*, 1947).—Describes underwater loudspeakers and microphones covering the range 20 c/s to 20 Mc/s. Small diaphragms can be used compared with air radiators. Formulae are given for calculating the power output and frequency response by using the equivalent electrical and mechanical networks. A large m.c. speaker is illustrated having an output of 200 W and frequency response 40 to 8 000 c/s. Performance is given for an unpolarized armature type. Velocity and condenser microphones are treated. The condenser microphone was designed to work from 100 to 6 000 cycles and remain in a depth of 100 ft of water for one year without servicing. A dynamic speaker with a response from 10 to 100 kc/s is described. Using quartz crystals for both microphone and loudspeaker, frequencies up to 20 000 kc/s have been attained. B. B. A.

534.25 2751

Refraction of waves from a point source into a medium of higher velocity. GERJUOY, E. *Phys. Rev.*, **73**, 1442–9 (*June* 15, 1948).—A point source is placed in one medium and the fields in a second medium, separated from the first by an infinite plane boundary, are calculated for the case that the wave velocity in the second medium exceeds that in the first medium. Absorption is neglected and the problem is solved both by ray methods and by evaluation, by the method of steepest descents, of an exact solution of the wave equation. Rays incident on the boundary at angles exceeding the critical angle are totally reflected; directly transmitted energy penetrates to all points in the second medium. At points in the second medium outside the critical angle, near the surface and far from the source, the directly transmitted fields are much smaller than the fields, exponentially decaying from the surface, which result from totally reflected rays. An experiment to measure quantitatively the penetration of the fields into the second medium in total reflection is easily performable for the case of sound waves penetrating from air into water. A.

534.321.4 2752

Some measurements of the end-corrections and acoustic spectra of cylindrical open flue organ pipes. INGERSLEV, F., AND FROBENIUS, W. *Trans. Danish Acad. Tech. Sci.* (*No.* 1) 7–44 (1947) *In English.*—A method is described for measuring the harmonic components, sound pressure and equivalent loudness in phons of flue organ pipes. It is found that a reduction of pipe diameter relative to length will cause an increase in the amplitudes of the higher harmonic components and a slight decrease in amplitude of the fundamental frequency. There is a tendency towards the pipe with the broadest mouth having the stronger higher harmonics. The less the air consumption, the more dominating is the fundamental frequency. The lower the height of the mouth, the more powerful are the higher harmonics compared with the fundamental. The

influence of the pipe body on the radiated sound is also discussed. A. B. W.

534.321.9 : 541.68 = 4 2753

Action of ultrasonics on certain aromatic hydrocarbons. MASTAGLI, P., MAHOUX, A. P., AND BRICARD, A. *C.R. Acad. Sci., Paris*, **226**, 667–8 (*Feb.* 23, 1948) *In French.*—100 ml of liquid contained in a Dewar vessel of spherocylindrical form and diameter 6 cm were subjected to ultrasonic radiation and the rise in temperature after 5 min was measured. The mean temperature increase per min was determined for C_6H_6 (4·04°), toluene (3·82°), xylene (3·80°), mesitylene (3·50°), *p*-cymene (3·40°), cumene (3·60°), and ethylbenzene (3·0°). The thermal effect is specific for the substance and does not appear to be related to the mol. wt. or mol. constitution. W. R. A.

534.321.9 : 621.391.63 = 5 2754

Distortions in light-modulation by ultrasonic cell. SETTE, D. *Alta Frequenza*, **17**, 51–68 (*April*, 1948) *In Italian.*—[Abstr. 2234 B (1948)].

534.614 + 535.372 + 535.375.5 *see Abstr.* 2789

534.614 : 537.531 : 535.43 : 548.7 = 4 2755

Velocity dispersion of acoustic waves in aluminium. OLMER, P. *Acta Cryst.*, **1**, 57–63 (*May*, 1948) *In French.*—Intensity measurements of X-ray diffuse scattering by single crystals of Al at ordinary temperatures give information on the mode of propagation of transverse and longitudinal elastic waves in the crystal. Using monochromatic radiation, each intensity (measured by an ionization chamber) can be expressed in terms of an *average total scattering power* (including Compton scattering) which has to be corrected (*a*) by a divergence factor corresponding to the resolving power of the spectrometer; (*b*) for the Compton effect associated with an atom-forming part of a crystal; (*c*) for 2nd and 3rd order scattering due to simultaneous scattering on 2 or 3 acoustic waves; and (*d*) for the true quantized energy distribution among the acoustic waves. From these results the phase velocities of longitudinal and transverse elastic waves in Al are obtained as functions of the elastic wave vector $S = 1/\lambda$. For very small values of S (long acoustic waves), the velocities found correspond to those quoted in the literature for static measurements. Otherwise a remarkable curve of dispersion, $v = f(S)$, is established for the elastic waves, which for transverse waves makes $f(S)$ very nearly a sine function such as would be expected if only the 12 nearest neighbours about each atom interacted with it. For longitudinal waves this is definitely not the case. A.

534.76 = 5 2756

Super-angles in biauricular hearing. BOLLE, A., LO SURDO, A., AND ZANOTELLI, G. *Ric. Sci. Ricostruz.*, **17**, 1991–6 (*Dec.*, 1947) *In Italian.*

534.844.1 : 621.317.351 2757

Measuring reverberation time by the method of exponentially increasing amplification. TAK, W. *Philips Tech. Rev.*, **9** (*No.* 12) 371–8 (1947–48).—The reverberation time of an enclosed space can be measured by producing in that space periodical sound impulses and transferring the voltage from a microphone set up within the space to an oscillograph via an exponential amplifier. The amplification begins every time with a low value but increases exponentially with time by a certain amount, say 60 db, and then drops back to the initial low value. The rhythm of the sound impulses and of the exponential variation in amplification is determined by the generator of the oscillograph time-base voltage. The frequency of this voltage is regulated in such a way that the oscillogram shows as far as possible a constant amplitude; when this is the case, the period corresponding to that frequenc ≃ the reverberation time sought. Components of th apparatus and results of measurement are discussed. A

534.845 = 3 275

The meaning of sound absorption in water. KNESER, H. O Letter in *Naturwiss.*, **34** (*No.* 2) 53–4 (1947) *In German.*— Absorption of sound in water is characterized by th expression $A = 2\alpha/f^2$ (in 10^{-17} cm^{-1} sec^2), where α is th absorption coeff. of amplitude and f is the frequency The following results: (1) For $f > 8$ Mc/s, A lies betwee 40 and 50; (2) for $f < 6$ Mc/s, A lies between 6 and 7 (3) in the high-frequency region water-acetone and wate ethylalcohol mixtures show maximum absorption for determined mean concentration; water-glycerin mixture do not; (4) in the high-frequency region A increase rapidly with decrease of temperature. These propertie of water and water mixtures are discussed. The classica theory of viscosity is unable to explain them satisfactorily A molecular theory involving the interaction of vibratin and non-vibrating molecules of H_2O is put forward i explanation. The meaning of sound absorption i electrolytes is also discussed. A. B. W

534.845 = 3 275

Relaxation of thermal oscillations as the explanation o sound absorption in liquids. KNESER, H. O. Letter i *Naturwiss.*, **34** (*No.* 2) 54 (1947) *In German.*—An extensio of the theory of sound absorption in water [see Abstr 2758 (1948)] to liquids. The expression for the soun absorption $A = 2\alpha/f^2$ is modified by the introduction o A_{kl} which is that part of A due to viscosity and therma conductivity. This expression

$$A - A_{kl} = 4\pi^2 C_s \tau^2 (C_p - C_v)/C_p C_v \,.\, V,$$

in which V = velocity of sound, C_p and C_v specific heat at constant press. and volume, C_s vibrational heat, an τ the relaxation time, is independent of frequency and enables an estimate of τ to be made. The pape contains a table giving these values for a selection o organic liquids and water. A. B. W

OPTICS . RADIATION . SPECTRA 535

535.14 : 612.84 *see Abstr.* 3049

535.215.4 : 621.383.4 : 535.415 = 82 *see Abstr.* 2801

535.223 : 621.396.611.4 : 538.566 *see Abstr.* 2887

535.232 : 621.384.6 : 537.533 *see Abstr.* 2859

535.234 : 537.591 = 4 *see Abstr.* 2867

535.24 = 4 276

New source of error in heterochromatic photometry BLET, G. *C.R. Acad. Sci., Paris*, **226**, 712–13 (*March* 1948) *In French.*—If red light is compared with green b comparing each in turn with yellow, using a flicke photometer, the results obtained differ by 2–3% accordin to the order in which the measurements are made. J. W. T. W

535.24 = 6 276

Present day problems of photometry. OTERO NAVASCUÉ J. M. *Rev. Cienc. Apl.*, **2**, 1–14 (*Jan.–March*, 1948) *Spanish.*—Reviews the theory and basic principles o photometry and discusses alternative systems of nomen clature. The primary standard of light and the metho of visual heterochromatic photometry are describe The application of these and of photoelectric methods t the measurement of modern light sources is mentione and a description is given of the special methods use for measuring very low values of illumination an brightness. The paper concludes with an enumeratio of the problems awaiting investigation. J. W. T. W

535.24 : 535.338.334 = 82 *see Abstr.* 2777

535.24 : 535.65 = 5 2762

Heterochromatic photometry. GARELLI, C. M. *Nuovo Cim.*, **3**, 152–85 (1946) *In Italian.*—Problems and fundamentals of coloured light photometry are discussed. Objective and subjective practical methods are criticized and discussed; particular attention is paid to methods of obtaining the visibility curve. G. R.

535.242.62 : 612.84 *see Abstr.* 3050

535.315 = 3 2763

The length of Dove prisms. GÜNTHER, N. *Optik*, **2**, 243–4 (*Aug.*, 1947) *In German.*—A method of determining the angle of the prism to give a short length. H. H. HOP.

535.315 : 522.59 = 3 *see Abstr.* 2658

535.317.4 = 3 2764

Method of comparison of power series coefficients of spherical aberration. KORFF, G. *Z. InstrumKde*, **63**, 81–90 (*March*, 1943) *In German.*—The spherical aberration of lenses may be expressed in the form of a power series. The author shows how to calculate the optimum correction by comparison of the relative values of the coefficients, when a 2-coefficient and a 3-coefficient power series is used for the spherical aberration. Numerical examples illustrate the method. V. W. R.

535.317.4 : 535.42 = 4 2765

Study of the combined effects of diffraction and geometrical aberrations on the image of a luminous point. II. Mechanical integration. MARÉCHAL, A. *Rev. Opt. (Théor. Instrum.)* **27**, 73–92 (*Feb.*, 1948) *In French.*—[Part I, Abstr. 3462 (1947)]. The diffraction integral for the case of a circular aperture and of a wave suffering from aberration is expressed as an integral along a spiral path. A mechanical integrator of the wheel and disc type is described, in which the various terms of the aberration function, together with terms denoting change of focus and displacements in the image plane are generated mechanically, their sum being communicated to a steel tape. By means of two integrating units the real and imaginary parts of the complex amplitudes of the light disturbance are found. The magnitudes of the different aberration terms can be varied independently. Formulae for aberration tolerances derived in Part I have been verified, and cases of astigmatism and spherical aberration have been studied. H. H. HOP.

535.317.5 : 535.8 = 4 *see Abstr.* 2807

535.317.6 = 3 2766

The principle of total aberration error in trigonometric calculation methods. KORFF, G. *Z. InstrumKde*, **63**, 1–8 (*Jan.*, 1943) *In German.*—The author shows that, contrary to the Gaussian princple, the lens error correction cannot be determined independently of the properties of the correcting system. With the trigonometric calculation method, widely differing systems may have identical numerical coefficients, but the best correction cannot be interpolated therefrom, because the rate of change of these numerical coefficients is different for the various correcting systems. V. W. R.

535.317.6 = 3 2767

Representation of astigmatic deviations and their zones by cross-aberration expressions, and division into component areas of the deviation from isoplanism. THOMESCHEIT, A. *Z. InstrumKde*, **63**, 309–14 (*Sept.*, 1943) *In German.*—The astigmatic aberration of skew light rays and their corresponding zones are determined in terms of a cross-deviation. Similar cross-aberration expressions are developed for chromatic deviation of axial parallel rays. Even in the case of infinitely small aperture finite values of aberration are obtained in the Gaussian image plane. The deviation from the isoplanism and coincidence criterion is analysed into component zones. The theory is applied to a photographic lens example. V. W. R.

535.317.6 : 535.83 = 4 2768

On the calculation of erecting systems of two identical lenses. BIOT, M. A. *Ann. Soc. Sci. Brux.*, **62** (*Sér.* 1) 36–9 (*March* 3, 1948) *In French.*—The objective and eyepiece of a telescope are specified, together with the overall magnification and length. The separation and focal length of two identical lenses are then calculated which give the required magnification, overall length and position of exit-pupil. H. H. HOP.

535.322.4 = 3 2769

Theory of the refractometer. SCHULZ, H. *Z. InstrumKde*, **63**, 261–5 (*Aug.*, 1943) *In German.*—Deals with refractometers determining the refractive index of the sample by measuring the angle for total reflection. By means of a second compensating prism the refractometer scale can be made nearly linear. The author investigates the best position and angle of the compensating prism for approx. linear scale, and calculates the errors for various prisms and refractive indices. V. W. R.

535.33 : 523.87 = 4 2770

Reproduction in the laboratory of the 4 050 Å group of spectra in the heads of comets. HERMAN, R. *C.R. Acad. Sci., Paris*, **223**, 280–3 (*Aug.* 5, 1946) *In French.*—The spectral lines extend from 3 980 to 4 140 Å, and were produced by a discharge between C electrodes in H_2 strongly diluted in an atmosphere of rare gas. Tables of the measured wavelengths are given and compared with the results of other workers. L. S. G.

535.33 : 523.87 = 4 *see Abstr.* 2679

535.338 2771

Investigations of the band-spectrum of beryllium oxide. LAGERQVIST, A. *Univ. Stockholm (Inaug. Diss.)* 98 *pp.* (*Almqvist & Wiksells Boktryckeri A.B., Uppsala*, 1948) *In English.*—A detailed account of work, much of which has been published elsewhere [Abstr. 2242 (1945); 1289, 1577 (1946); 76, 3471 (1947)]. New observations on the ultraviolet bands are also reported, but it has not been possible to analyse them completely, and some assignments of earlier workers are doubted. The electronic states are discussed: it is concluded that the products of dissociation of the lowest $^1\Sigma^+$ state are probably $Be(^1S) + O(^1D)$, the energy of dissociation, D_0, being about 5·9 eV. R. F. B.

535.338 : 535.34 *see Abstr.* 2780

535.338 : 535.372 = 4 2772

Origin of the phosphorescence spectrum of krypton. HERMAN, L., AND HERMAN, R. *C.R. Acad. Sci., Paris*, **226**, 654–6 (*Feb.* 23, 1948) *In French.*—The spectra of the phosphorescence of Kr and of the exciting discharge have been examined at various gas pressures and different conditions of excitation. The changes in the spectrum cannot be completely accounted for by a simple theory of ionic recombination; the processes involved are discussed. A. G. G.

535.338 : 537.228.5 2773

On the influence of electric fields on the energy levels of argon II. MINNHAGEN, L. *Ark. Mat. Astr. Fys.*, **35 A** (*Paper No.* 16) 11 *pp.* (1948) *In English.*—A study of the Stark effect of about 80 lines in the visible spectrum of A II. Twenty lines are displaced, and the configuration interactions producing this effect are discussed. L. P.

535.338 : 537.228.5 2774

A note on the Stark effect in diatomic molecules. NIERENBERG, W. A., RABI, I. I., AND SLOTNICK, M.

Phys. Rev., 73, 1430–3 (*June* 15, 1948).—The hyperfine splitting of the energy levels of a polar diatomic molecule in a constant electric field caused by the presence of $\mathbf{I}\cdot\mathbf{J}$ interactions between each nucleus and the other charges of the molecule and a quadrupole interaction involving one of the nuclei is calculated. The calculation explains recent measurements of Trischka on molecular beams of CsF and KF. For weak fields a method is given for computing the fine structure splitting resulting from any form of interaction, provided one nucleus interacts more strongly than the other. A.

535.338.1 : 535.343.1 2775

On the band spectra of the hydrides and deuterides of Cu, Ag, Au and Al. Nilsson, B. E. *Univ. Stockholm* (*Acad. Diss.*) 53 *pp.* (1948) *In English.*—Studies of the CuH (λ4280) and CuD band-systems lead to the conclusion that the intensity anomalies result from predissociation and not from the excitation process as suggested recently [Abstr. 3115 (1947)]. No such effects have been observed in the systems of AgH (λ3330), AuH (λ3652) or AuD. Some of the work on AlH and AlD has been published elsewhere [Abstr. 1468 (1947); 1487 (1948)]: further investigations of the AlH band (λ4240) are described. R. F. B.

535.338.3 : 539.133 2776

The pure rotational spectrum of ICl. Townes, C. H., Merritt, F. R., and Wright, B. D. *Phys. Rev.*, 73, 1334–7 (*June* 1, 1948).—Frequencies and intensities of a number of lines of the $J = 3 \rightarrow 4$ rotational transition of ICl were measured and the spectrum analysed. Constants were obtained for ICl^{35}. The mass ratio Cl^{35}/Cl^{37} obtained from this spectrum is 0·9459801, which appears inconsistent with the most recent mass-spectroscopic determination. The molecular dipole moment is approximately $0{\cdot}65\times10^{-18}$ e.s.u. from intensity measurements. A.

535.338.333 : 539.155.2 *see Abstr.* 2908

535.338.334 : 535.24 = 82 2777

On the possibility of low-inertia photometry and demodulation analysis of light. Gorelik, G. *C.R. Acad. Sci. URSS*, 58 (*No.* 1) 45–7 (1947) *In Russian.*—Theoretical possibilities of low inertia photometry, taking into account individual intensities radiated by single atoms, are analysed. The "average frequency" in the case of a spectral line, i.e. reciprocal of the average time separating two statistically independent intensity observations, can be equal in width to the spectral line and be of the order 10^8–10^{10} c/s. A non-inertial photoelement responding to frequencies up to 10^8 c/s constructed from a Kerr cell would, when exposed to the above spectral line, yield a pulsed photo-current with random modulation which could be matched into the input system of an amplifier-analyser. This demodulation of light would be simpler at lower modulation frequencies, i.e. with narrow spectral lines, where the usual spectroanalysis presents biggest difficulties. A. L.

535.338.4 : 539.13 *see Abstr.* 2894

535.338.4–31 2778

Ultra-violet bands of zinc iodide. III. Ramasastry, C. *Indian J. Phys.*, 22, 119–28 (*March*, 1948).—For previous work see Abstr. 1474 (1947). The band system lying between λ2450–2250 Å was photographed on the Hilger Littrow quartz spectrograph. Each band consists of three component heads, which are shown to be due to the three isotopic molecules $Zn^{64}I^{127}$, $Zn^{66}I^{127}$ and $Zn^{68}I^{127}$, thus confirming the existence of the isotope 68 of Zn for the first time from the study of bands. A.

535.338.4–31 2779

Ultra-violet bands of mercury iodide. IV. Ramasastry, C. *Indian J. Phys.*, 22, 95–105 (*March*, 1948).—For earlier work see Abstr. 290 (1948). The band spectrum was reinvestigated in the region λ2250–2540 Å using the Hilger medium and Littrow quartz spectrographs. The F_1 and F_3 systems are considerably extended and a new vibrational analysis is suggested, consistent with the red degradation of the bands. About 50 bands are ascribed to the F_1 system, and 80 bands to the F_3 system; formulæ for the bands are given. The agreement between the vibrational constants and the similarity in character and appearance of the F_1 and G band systems suggest that they probably form the two components of a $^2\pi - {}^2\Sigma$ transition. If this is correct, the $^2\pi$ width is 5 490 cm^{-1}. A.

535.339 : 548.73 *see Abstr.* 3006

535.34 : 535.338 2780

The effect of collisions on the continuous absorption spectra. Dutta, A. K., and Roy, A. *Indian J. Phys.* 22, 51–4 (*Feb.*, 1948).—The spectra of polar molecules were found to shift towards longer wavelength by collisions with both polar and non-polar gases. The change in absorption co-efficient depends on the number of collisions suffered by a molecule with the foreign gas and reaches a maximum value with a definite proportion of the absorbing gas and foreign gas, irrespective of the polarity of the foreign gas. With inert foreign gas it appears that there is a sort of screening giving rise to a decrease in the absorption coefficient value after the maximum is reached. The spectra of the HI and CCl molecules were studied. A

535.343 : 541.65 *see Abstr.* 2973

535.343.1 : 535.338.1 *see Abstr.* 2775

535.343.2 : 535.372 *see Abstr.* 2786

535.343.2–15 278

The infra-red absorption spectrum of diamond and its variations. Ramanathan, K. G. *Proc. Indian Acad. Sci. A*, 26, 469–78 (*Dec.*, 1947).—The infra-red absorption spectra of 9 cleavage plates of diamond were investigated between 750 and 4 000 cm^{-1} and the spectral behaviour elucidated. The 1st-order spectrum shows large variations whilst the 2nd-order spectrum is similar for all. Therefore, 1st-order activity would appear to be attributable to the tetrahedral symmetry of structure rather than to chemical impurities or mosaicity. W. R. A.

535.345–31 : 666 278

Transmission of bactericidal radiation through glass. Stanworth, J. E. Letter in *Nature, Lond.*, 161, 85 (*May* 29, 1948).—Soft glasses with expansion coeff. $\sim 9{\cdot}5\times10^{-6}$ and containing up to 0·01% Fe can be made with a good transmission at 2 537 Å. These can be used in place of hard borosilicate glasses in bactericidal lamps.

535.347 : 549.623.5 : 548.538 = 69 *see Abstr.* 2985

535.361 = 5 278

Light diffusion through opal glasses. Lovera, G. *Nuovo Cim.*, 3, 61–80 (*April*, 1946) *In Italian.*—The total transmission and reflection of an opal glass and the minimum thickness suitable for making invisible the filament of a given source, are obtained by three photometric measurements and by the formulae of Ryder and Cooper's theory. G. R

535.37.08 = 82 278

The study of the decay of luminescence by means of a cathode ray oscilloscope. Tolstoy, N. A., and Feofilov, P. P. *C.R. Acad. Sci. URSS*, 58 (*No.* 3) 389–92 (1947) *In Russian.*—Describes a rotating disc phosphoroscope with cathode ray tube presentation using exponential time base derived from auxiliary light source. The tim

constant (10^{-1} to 10^{-5} sec) of the timebase circuit is adjustable and gives a linear trace when equal to the decay time constant of the phosphor. The method can be extended to non-exponential decay laws, for both flash and afterglow. M. G. G.

535.371 = 82 2785

The influence of activator concentration on the phosphorescence of organic luminophors. SVESHNIKOV, B. Y. *C.R. Acad. Sci. URSS*, **58** (*No.* 1) 49–52 (1947) *In Russian.*—Jablonski's theory [Abstr. 2054 (1935)] of metastable levels and two states of phosphorescence (first with an optimum at room temperatures; second, of longer λ, with rapidly increasing intensity at low temp.) is confirmed experimentally. Main features of the technique described are: deliberate de-focusing of the light source image on the luminescent target, to avoid intensity variations due to the optical system adjustments; excitation period $\gg$ duration of the metastable condition; polarization measured in the green part of the spectrum only; pentane or CCl_4 used for protection of the boric phosphors under investigation instead of the usual oil. The results are summarized in tables and curves. A. L.

535.372 : 535.338 = 4 *see Abstr.* 2772

535.372 : 535.343.2 2786

The emission and absorption spectra of luminescent diamonds. RAMANATHAN, K. G. *Proc. Indian Acad. Sci. A*, **26**, 479–80 (*Dec.*, 1947).—Microphotometric records of emission and absorption spectra photographs of blue luminescent diamonds show the discrete structure of the vibration spectrum. W. R. A.

535.372 : 535.375.5 *see Abstr.* 2788

535.372 + 535.614 + 535.375.5 *see Abstr.* 2789

535.375.5 2787

Raman spectra of substituted arsenic acids. GUPTA, J., AND GUHA, M. P. *Indian J. Phys.*, **22**, 64–8 (*Feb.*, 1948).—The effect of progressive substitution of oxygen atoms in the arsenate ion $[AsO_4]''$ by methyl groups was studied. The spectrum of methyl arsenate ion $[(CH_3)AsO_3]''$ reveals that a tetrahedral skeleton is maintained. The spectra of normal and secondary arsenates were re-examined. Approximate force constants were calculated. Bond strengths of As–C and As–O appear to be alike in the substituted arsenates. A.

535.375.5 : 535.372 2788

The Raman effect in topaz and its relation to the luminescence spectrum. KRISHNAN, R. S. *Proc. Indian Acad. Sci. A*, **26**, 460–8 (*Dec.*, 1947).—The Raman spectrum of topaz, excited by the 2 536·5 Å Hg resonance line, shows 32 displacements, 21 of which have not been reported previously. Raman shifts correspond completely with the frequency shifts of the vibrational bands in luminescence. W. R. A.

535.375.5 + 535.372 + 534.614 2789

Raman spectrum of alumina and the luminescence of ruby. KRISHNAN, R. S. *Proc. Indian Acad. Sci. A*, **26**, 450–9 (*Dec.*, 1947).—Crystalline alumina, excited by the 2 536·5 A Hg resonance line, gives a light-scattering spectrum comprising 2 Doppler-shifted components centred round the exciting line and 7 Raman displacements. From the measured shift of the Doppler components the velocity of sound in alumina has been computed. The appearance of 7 Raman lines supports the theoretical predictions of Bhagavantam *et al.* [Abstr. 2548 (1939)]. The numerous bands appearing on both sides of the principal fluorescence doublet of ruby are explained as arising from combination of the vibration frequencies of the alumina lattice with the electronic transitions of the Cr ions. W. R. A.

535.375.5 : 548.7 2790

The Raman spectrum of rocksalt and its interpretation. KRISHNAN, R. S. *Proc. Indian Acad. Sci. A*, **26**, 419–31 (*Dec.*, 1947).—Careful microphotometric examination of spectrograms taken under high dispersion shows that the Raman spectrum of rocksalt consists of an aggregate of discrete lines, some of which are more intense than others. With the aid of the Raman theory for crystals, 9 lines are identified as octaves and the rest as combinations of the 9 fundamental frequencies of the rocksalt lattice. Views expressed by Born and Bradburn [Abstr. 1353 (1947)] are considered to be untenable. W. R. A.

535.375.5 : 548.7 2791

Raman spectrum of ammonium chloride and its variation with temperature. KRISHNAN, R. S. *Proc. Indian Acad. Sci. A*, **26**, 432–49 (*Dec.*, 1947).—The Raman spectrum of NH_4Cl, excited by 2 536·5 A Hg resonance line, was investigated from 85° to 395°K. Between 90 and 200 cm^{-1} there are 7 lattice lines, showing variation in frequency shifts and intensities with temp., which are identified as the fundamental modes of vibration of the CsCl structure in which NH_4 ions oscillate as units in agreement with the new crystal dynamics of Raman. The lattice spectrum persists far above the transition temperature, suggesting that Pauling's view that there is an onset of free rotation of NH_4^+ ions just above the transition temp. is wrong. The internal oscillations of the NH_4 ions exhibit 9 distinct Raman shifts, indicating that the oscillations are not in any way connected with a freely vibrating tetrahedrally symmetrical group. At all temp. there is evidence of the existence of HCl and NH_3 molecules. W. R. A.

535.375.5 : 548.7 2792

Influence of temperature on the Raman spectra of crystals. I. Calcite. NARAYANASWAMY, P. K. *Proc. Indian Acad. Sci. A*, **26**, 511–20 (*Dec.*, 1947).—Raman spectra of calcite, excited by 2 536 A Hg resonance line, at 10 temp. between 90° and 698°K have been studied. All lines show decrease in frequency shifts with increase in temp., but lattice lines are more markedly affected than internal oscillations of the CO_3 group. The width of the line increases with temp. and the peak intensity decreases. Temp.-variations of these various factors are similar in character. W. R. A.

535.375.5 : 548.7 2793

Influence of temperature on the Raman spectra of crystals. II. Quartz. NARAYANASWAMY, P. K. *Proc. Indian Acad. Sci. A*, **26**, 521–30 (*Dec.*, 1947).—Data regarding the variations in frequency shift, dv, breadth, and $d \log v/dT$ for 12 important Raman lines of quartz are derived from spectra measured at nine temps between 85° and 685°K. W. R. A.

535.375.5 : 548.7 : 535.43 2794

The scattering of light in diamond and its Raman spectrum. KRISHNAN, R. S. *Proc. Indian Acad. Sci. A*, **26**, 399–418 (*Dec.*, 1947).—Studies were made using 2 536·5 A Hg resonance radiation. The scattered spectrum has two pairs of Doppler-shifted components, one due to the longitudinal sound waves, the other due to the two sets of transverse sound waves of approx. the same velocity. Velocities of longitudinal and transverse sound waves, calculated from the observed frequency shifts of the displaced components agree with those computed from elastic constants. The directional dependence of sound velocity in diamond has been quantitatively verified. Longitudinal Doppler components are less intense than transverse. The 2nd-order

spectrum of diamond was examined with high dispersion and resolution and displays many sharply defined Raman lines, the 15 most prominent of which are satisfactorily explained as octaves or combinations of 6 of the 8 fundamental frequencies of vibration of the diamond lattice to be expected on the basis of the Raman theory. W. R. A.

535.376 : 548.7 2795

The new phenomenon of electrophotoluminescence and its possibilities for the investigation of crystal lattice. II. The momentary illumination produced by disactivation of the long duration centres. (Gudden and Pohl effect, 1920.) DESTRIAU, G. *Phil. Mag.*, **38**, 774–93 (*Nov.*, 1947).—A continuation of previous work [Abstr. 1517 (1948)]. The establishment of momentary illumination [Abstr. 2849 (1947)] is discussed, and its intensity is graphed as a function of the duration of irradiation by X-rays. Hysteresis is possible, e.g. with mixed ZnS and CdS. A theory of the momentary illumination is given. Extinction of the illumination by means of infra-red rays is studied. L. S. G.

535.379 = 82 2796

A new type of ZnS luminophores. FRIDMAN, S. A., AND CHEREPNEV, A. A. *C.R. Acad. Sci. URSS*, **59** (*No.* 1) 53–6 (1948) *In Russian.*—ZnS luminophores have lately been able to compete successfully with the usual type of earth-alkali metal sulphide ones, mainly owing to their greater constancy against external influences. Yet up to the present this was offset by an insufficient duration of the after-glow. The authors have succeeded in overcoming this drawback by obtaining a hyperbolic decay curve of intensity above that of the known type of ZnS luminophore. This results in an integral output exceeding that of the earth alkali type.

535.39 = 3 2797

Reduction of reflection from glass surfaces by means of several homogeneous interfering layers. HIESINGER, L. Letter in *Naturwiss*, **34** (*No.* 4) 121 (1947) *In German.*—The condition that the reflected wave be suppressed when a glass of index n_g is covered with four layers, n_1, n_2, n_3, n_4, is $n_2n_4/n_1n_3 = \sqrt{n_g}$. By giving various values to n, a variety of cases is considered which indicate the possibility of the practically complete suppression of reflected light in a given wavelength range, using known materials. H. H. HOP.

535.39 = 4 2798

Extinction incidences in the case of glass reflections having two parameters. ARZELIÈS, H. *Rev. Opt.* (*Théor. Instrum.*) **27**, 137–56 (*March*, 1948) *In French.*—Plane waves are considered, incident on a system of one or two reflecting interfaces, corresponding to the cases of a single reflecting surface and a coated surface. The conditions for extinction of the reflected wave are derived in a variety of cases. H. H. HOP.

535.39–4 = 4 2799

Properties of the evanescent wave obtained at total reflection. ARZELIÈS, H. *Rev. Opt.* (*Théor. Instrum.*) **27**, 205–44 (*April*, 1948) *In French.*—A detailed account of the amplitude and its attenuation, phase and its propagation, and energy considerations of the wave penetrating the second medium. H. H. HOP.

535.41 = 3 2800

The principle of "reversed interference" and its applications. TORALDO DI FRANCIA, G. *Z. InstrumKde*, **63**, 356–8 (*Oct.*, 1943) *In German.*—The author shows that if a parallel plane wave be incident on a grating and the transmitted rays are then subject to a periodic intensity variation due to the periodic grating transparency, then an infinite number of "conjugate" interfering pairs of waves are produced on the other side. These waves are such as would produce the same periodic intensity variation by interference, if acting alone. A number of inhomogeneous or surface waves are also produced, and are mathematically imaginary. The principle of "reversible interference," when applied to unsymmetrical gratings, circular apertures and discs, and some light propagation anomalies, yields results more in accordance with experimental facts than the Huyghens–Fresnel principle. V. W. I.

535.415 : 535.215.4 : 621.383.4 = 82 280

On films of antimony-caesium composition. BORZYAK, P. G. *C.R. Acad. Sci. URSS*, **56** (*No.* 8) 815–17 (1947) *In Russian.*—Sb–Cs films exposed to monochromatic light of long wavelength show interference bands which spread into spectra under exposure to white light so long as the film layers are thin. When heated the Cs component can be removed by getter process, and the resulting colour shift from the original red to brown, yellow-green and pink is observed up to 320°C, when the film dissolves entirely. General photo-current characteristics are investigated and plotted. A. I.

535.42 : 535.317.4 = 4 *see Abstr.* 2765

535.42 : 535.82 : 621.385.833 280

A new microscopic principle. GABOR, D. *Nature, Lond.*, **161**, 777–8 (*May* 15, 1948).—Interference between the primary wavefront and secondary waves scattered from an object illuminated by monochromatic radiation diverging from a point focus will produce on a photographic plate some distance away a pattern which records both amplitudes and phases of the scattered radiation. If the image thus recorded is viewed by light from a point source at the same distance, an image of the original object should be recreated. An example of the result of optical recording and synthesis shows that this is experimentally possible, at least partially. The synthesized image will be 3-dimensional. The application of electron beams to the analysis is discussed, offering an extension of the resolving power at present limited by spherical aberration.

535.43 : 551.593 *see Abstr.* 3041

535.43 : 537.531 : 548.7 : 534.614 = 4 *see Abstr.* 2755

535.43 : 548.7 : 535.375.5 *see Abstr.* 2794

535.43 : 551.593.5 = 82 280

Applicability of the nephelometric method in the determination of visibility and extinction factor in thick smoke and fog. VEITSER, V. J. *J. Tech. Phys. USSR*, 1 (*No.* 4) 469–74 (1947) *In Russian.*—Theoretical and experimental investigations show that the distance of visibility in the horizontal plane is determined equally by the simultaneous effects of absorption and scattering and, to a first approximation, $\propto$ (attenuation factor)$^{-1}$. It was confirmed experimentally on dense mists that, in the case of aerosols, the nephelometric method yields exaggerated values of visible distance. It is concluded that the nephelometric method of determining transparency of an atmosphere, disregarding degree of light absorption and spatial non-uniformity, cannot be recommended for investigating dense mists, dust atmospheres and artificial smoke clouds. R. I.

535.435 : 532.74 = 3 280

Calculation of shape and size of molecule clusters in liquids from light scattering data. NEUGEBAUER, T. *Z. Phys.*, **122** (*Nos* 5–8) 471–86 (1944) *In German.*—Calculations of the intensity of the horizontal component of the electrical vector of light waves scattered at right angles by ordered molecule clusters of a size comparable

with the wavelength, with the electric vector of the incident light either horizontal or vertical. The ratio of these two intensities is given as a function of the shape and size of the cluster, and it is independent of the value of the anistropy of the scattering molecule. Discrepancies with earlier less rigid calculations are discussed. H. L.

535.542.1 : 535.55 2805

A large field compensator of the Berek type. FISHER, W. A. P. Letter in *Nature, Lond.*, **161**, 848 (*May* 29, 1948).—[See Abstr. 2097 (1948)].

535.55 : 535.542.1 *see Abstr.* 2805

535.551 : 539.32 : 548.0 *see Abstr.* 2980

535.56 = 4 2806

Anistropy of natural rotatory power. LÉVY, M. *C.R. Acad. Sci., Paris*, **226**, 652–4 (*Feb.* 23, 1948) *In French.*—Results only of theoretical (mathematical) investigations of the following problems are given. (*a*) Action of a longitudinal electric field on the rotatory power of non-polar molecules, (*b*) action of a longitudinal electric or magnetic field on the rotatory power of polar or paramagnetic molecules. The result of (*b*) is applied to the Kuhn model, and the general formulae are expressed in terms of the polarizabilities of the groups in the molecule. C. B. A.

535.568.1 : 522.615 = 4 *see Abstr.* 2659–60

535.65 : 535.24 = 5 *see Abstr.* 2762

535.8 : 531.715.27 = 3 *see Abstr.* 2729

535.8 : 535.317.5 = 4 2807

Vision in an instrument suffering from spherical aberration III. FRANÇON, M. *Rev. Opt. (Théor. Instrum.)* **27**, 157–73 (*March*, 1948) *In French.*—In previous results [Abstr. 85 (1948); this abstract also covers Pt II—"Study of visual focusing"] the deformation of the wave surface has been referred to the paraxial focus. The best focus is now chosen midway between this and the marginal focus, aberrations being then referred to this best focus. It is shown that with very low contrast test objects (*circa* 0·03), the maximum permissible eye pupil is 0·6–0·9 mm diameter, and aberrations of the order of $\lambda/16$ can be significant. The tolerance increases to $\lambda/4$ for contrasts of 1·00. This was shown experimentally using a 543 mm focus lens of 60 mm diameter, the aberration being controlled by means of a diaphragm. Test objects of varying contrast were produced using a rotating disc method. It is found that the best focus for high contrast is obtained nearer to the marginal focus: that for low contrast is nearer the paraxial focus. H. H. HOP.

535.81 2808

The manufacture of correction plates for Schmidt optical systems. RINIA, H., AND VAN ALPHEN, P. M. *Philips Tech. Rev.*, **9** (*No.* 12) 349–56 (1947–48).—A description of a new method. A mould is used the face of which is the negative of the plate required, but with the thickness dimensions exaggerated, e.g. 5×. A 20% gelatin solution is then applied on the mould and after it has dried it shows the desired shape. A.

535.81 : 548.0 = 3 2809

The optical properties of some crystals and their representation by the Hartmann equation. HARTING, H. *Z. InstrumKde*, **63**, 125–31 (*April*, 1943) *In German.*—Deals with the optical properties, refractive index and the Hartmann equation, which expresses the variation of refraction index with wavelength, of NaF, LiF, KCl, NaCl, KBr and KJ crystals, with a view to their possible use in Zeiss lenses. Tables are given showing the variation of refractive index with wavelength for these crystals, and the best values of the constants in Hartmann's equation are deduced therefrom. Possible uses for NaF in lenses are mentioned. V. W. R.

535.82 : 621.385.833 : 535.42 *see Abstr.* 2802

535.83 : 535.317.6 = 4 *see Abstr.* 2768

535.834 = 3 2810

Magnification and optimum eyepiece aperture of night field-glasses. WEMPE, J. *Z. InstrumKde*, **64**, 71–83 (*April–June*, 1944) *In German.*—The maximum possible magnification of field glasses when observing low light intensities is calculated from the light perception threshold curves of the human eye. This magnification is always < the geometrical magnification, and the ratio of the two is the utility factor. The latter varies with the light intensity, and different observers and objects. The optimum eyepiece aperture is investigated, and is found to be ~7 mm for night field glasses. If the adaptation of the eye pupil, which occurs with some observers, is taken into account, the best aperture reduces to 6 mm. V. W. R.

535.834 = 3 2811

The performance of field-glasses in daylight. BRUNNCKOW, K., REEGER, E., AND SIEDENTOPF, H. *Z. InstrumKde*, **64**, 86–9 (*April–June*, 1944) *In German.*—The vision magnifications of 8 field glasses and a binocular observation telescope were determined with a Landoltring test object having +17% and −15% contrast with surroundings. With hand-supported glasses the max. magnification is 6–7× owing to unavoidable hand movements. Even with supported glasses, the actual magnification is still smaller than the geometrical. This is thought to be due to optical defects. The utility factor of the glasses increases with the focal length. V. W. R.

535.89 = 4 2812

Production of white light with maximum efficiency. LE GRAND, Y. *C.R. Acad. Sci., Paris*, **225**, 1298–300 (*Dec.* 22, 1947) *In French.*—White light (C.I.E. Illuminant C) can be matched with a mixture of 450 and 569 mμ monochromatic lights and this mixture gives the highest theoretical efficiency (400 lumens/W). The colour rendering would be better with a 3-wavelength mixture, and a suitable combination is suggested. J. W. T. W.

HEAT 536

536.21 : 536.48 2813

Thermal conductivity of copper and German silver at liquid helium temperatures. ALLEN, J. F., AND MENDOZA, E. *Proc. Cambridge Phil. Soc.*, **44** (Pt 3) 280–8 (1948).—The apparatus and method for determining the conductivity are described, and a description is given of a technique for using Hg as a low-temperature solder, tight to He II. The values obtained for the conductivity of Cu agree reasonably with Makinson's theory [Abstr. 3759 (1938)]. It is deduced that Cu is a reasonably good material at low temperatures for thermal transfer in demagnetization experiments. For German silver only the lattice conductivity is important; scattering takes place with a mean free path of $\sim 10^{-3}$ cm. L. S. G.

536.21 : 628.81 = 3 2814

Heat flow in solid matter. RUNTE, E. *Bull. Ass. Suisse Élect.*, **37**, 643–51 (*Nov.* 2, 1946); **38**, 754–7 (*Nov.* 29, 1947) *In German.*—The paper derives mathematical expressions for the heat flow when heating matter by (*a*) a source of const. output, or (*b*) a heat source of const. temp., and for the heat flow having const. heat content in a symmetrical conducting plane. The results are used to investigate the heating time of a room with insulating walls, a room with heat-conducting walls and a room with

infinitely thick walls. The approx. heating time and input required to obtain a given room temp. is calculated by superposing the three cases, and numerical examples are given. The cooling of various types of room is mathematically investigated. The temp. distribution is proved to be nearly independent of the type of heat supply, and depends only on the total heat content of the space and the final wall temp. Typical heating and cooling cycles are calculated. V. W. R.

536.25 = 4 2815

Forced convection of heat in bundles of round, elliptical and profiled [profilé] tubes. RIBAUD, G., AND BROLA, G. *C.R. Acad. Sci., Paris*, **225**, 1225–7 (*Dec.* 22, 1947) *In French.*—Some experimental measurements of heat transfer between tubes of different dimensions and air flowing perpendicular to the bundles are reported.

536.42 : 536.7 = 4 *see Abstr.* 2819

536.46 : 537.566 : 621.43.04 = 4 2816

On the ionization phenomena accompanying the ignition of motor fuels by a hot point. VICHNIEVSKY, R. *C.R. Acad. Sci., Paris*, **225**, 992–4 (*Nov.* 24, 1947) *In French.*—The time variation of the ionization current produced in the neighbourhood of an exploratory electrode placed in the motor cylinder in a position diametrically opposite to the spark plug is used to follow exactly the flame propagation when ignition takes place in the presence of a heated filament. The curves for positively and negatively polarized electrodes differ considerably; that for the negative showing greater ionization but no irregularities, whereas the positive shows numerous irregularities which are important for the detection of knocking. The effects for increasing temperatures of the filament are examined and shown in photographs. [See *C.R. Acad. Sci., Paris*, **225**, 565 (1947)]. S. W.

536.48 : 536.21 *see Abstr.* 2813

536.587 : 621.316.74 = 393 2817

Compensation for the lag of a thermometer. SLOOVES, J. *Electro-techniek*, **26**, 168–9 (*May* 6, 1948) *In Dutch.*—[Abstr. 2150 B (1948)].

THERMODYNAMICS 536.7/.8

536.7 2818

Carbonyl chloride. Entropy. Heat capacity. Vapor pressure. Heats of fusion and vaporization. Comments on solid sulfur dioxide structure. GIAUQUE, W. F., AND JONES, W. M. *J. Amer. Chem. Soc.*, **70**, 120–4 (*Jan.*, 1948).—At 280·66°K, the entropy of $COCl_2$ calculated from molecular data exceeds the value calculated from calorimetric data by 1·63 g-cal per deg. per mol. The similar anomalous behaviour of SO_2 at temp. < the m.p. suggests that there is some random orientation in the solid molecules at low, but not too low, temp. W. R. A.

536.7 : 536.42 = 4 2819

The different types of transformation of a pure substance. JAFFRAY, J. *Ann. Phys., Paris* (*Sér.* 12) **3**, 6–135 (*Jan.–Feb.*, 1948) *In French.*—From considerations of the thermodynamic potential and its derivatives, transformations are classified in the manner first suggested by Ehrenfest, and the first 19 pages of this paper are given over to the development of the theory and the criticisms which have been advanced against it. In the following 10 pages a more detailed exposition of the classification of the types of transformation is made and diagrams given of the temperature variation of the thermodynamic properties in these changes. The second part gives a brief review of the experimental methods used for investigations on specific heat, latent heat, expansion and compressibility coefficients, as well as special methods applicable in particular cases. The third part is the most extensive, and reviews the experimental evidence regarding the different types of transformation. The discussion of 1st-order transformations, which are for the most part classical, has been reduced to a minimum. Second-order transformations, the number of examples of which has considerably increased recently, and connected transformations are assigned considerably more space. The final part deals with the general theories proposed to explain the mechanism of the transformations and more particularly those of the 2nd order. The theories are not given or discussed in detail, this part being intended as an introduction to a more complete study and serving only to indicate the principal hypotheses and different ideas which are current at the present time in this work. Nearly 300 references are given, mostly later than 1930. F. E. H.

536.75 : 532.13 : 537.32 2820

On the irreversible production of entropy. TOLMAN, R. C., AND FINE, P. C. *Rev. Mod. Phys.*, **20**, 51–77 (*Jan.*, 1948).—Equations for the first and second laws of thermodynamics as applied to any system are obtained in general terms. These are applicable where, in addition to the changes occurring in the system due to heat transfers and the performance of work, energy or entropy changes also occur due to mass transfers. The equation for the second law, in the form of an expression for the entropy change ΔS, includes a term ΔS_{irr} which represents the entropy change produced by irreversible processes occurring inside the system. Combining the two equations, an "efficiency equation," applicable to cyclical and steady state processes, is derived. This expresses the net work done by the system in terms of energy and entropy changes by mass transfers, heat transfers at temperatures other than that of the surroundings, and the entropy changes produced by irreversible processes within the system. The equation demonstrates how irreversible changes diminish efficiency. Six cases of irreversible entropy production are considered in detail and the entropy changes deduced. The "efficiency equation" is applied to the cases of (*a*) a simple heat engine, (*b*) heat engine with return of working fluid to boiler, (*c*) steady flow of fluids and (*d*) continuous flow processing plant. These examples illustrate the usefulness of the equation in analysing the causes of inefficiency in practical situations. The first and second law equations are directly applied to the problems of viscous flow and the thermoelectric effect. The latter application, whereby the usual relationships for the Peltier and Thomson coefficients are deduced, avoids the difficulties of many more familiar treatments. Finally the concept of temperature is discussed and the extent of its validity under non-equilibrium situations is analysed. F. E. H.

ELECTRICITY 537

537.122 : 530.145 *see Abstr.* 2712, 2714–15

537.122 : 530.145 = 4 *see Abstr.* 2709

537.122 : 530.145 = 6 *see Abstr.* 2713

537.122 : 537.591 = 5 *see Abstr.* 2868

537.122 : 539.166.835 *see Abstr.* 2923

537.133 : 530.145 *see Abstr.* 2716

537.133 : 539.152.2 = 4 *see Abstr.* 2903

537.212 2821

The electrostatic field distribution near a circular aperture or short cylinder. LIEBMANN, G. *Phil. Mag.*, **39**, 281–96 (*April*, 1948).—A method for computing field distribution is given. It is an extension of Bertram's

method [Abstr. 2810 (1942)]. Necessary tables for the computation are given and the results for some special cases are worked out. These include the potential distribution near three diaphragms. L. S. G.

537.226 2822

Dipolar interaction. FRÖHLICH, H. *Trans. Faraday Soc.*, **42 A**, 3–7; *disc.*, 36–9 (1946).—The main difficulty in treating this interaction is its long range ($\propto 1/r^3$, r = distance between dipoles) which does not allow a restriction to the interaction between nearest neighbours. Before discussing the various problems which arise, a survey is first given on the properties of independent dipoles, and then it is pointed out that the range within which the simplified methods of Debye (Clausius–Mosotti) and Onsager are valid has not always been respected. Kirkwood's attempt [Abstr. 4659 (1939)] to find an expression for the permittivity which holds over a wider range is discussed. It would appear that the effect of dipolar interaction on the permittivity in the case of solids is very different from that of liquids, in the former case leading to the formation of an ordered state, and in the latter case to high values for ε connected with a negative temperature characteristic. H. H. HO.

537.226 2823

The influence of hindered molecular rotation on the dielectric polarization of polar liquids. KIRKWOOD, J. G. *Trans. Faraday Soc.*, **42 A**, 7–12; *disc.*, 36–9 (1946).—Recently the author [Abstr. 4659 (1939)] has developed a formally exact theory of the dielectric polarization of polar liquids on the basis of classical statistical mechanics, which takes account not only of electrostatic hindering, but also hindering due to short-range intermolecular forces. When used in conjunction with suitable models of liquid structure, it provides a quantitative description of dielectric polarization of an accuracy consistent with that of the model employed. The results of the theory and some applications of it are now given, prior to which the physical background of the problem of the local field is considered. Reasonably reliable applications may be based upon rough quasi-crystalline models of local liquid structure in which each molecule possesses a co-ordination shell of nearest neighbours beyond which orientational correlation does not extend. When relative molecular rotation is strongly hindered, as in the case of H-bonded liquids such as water and the alcohols, further simplifications in the model of local liquid structure, which are physically plausible, may be made. H. H. HO.

537.226 2824

Theory of the crystalline field in solid and liquid polar dielectrics. BAUER, E., AND MASSIGNON, D. *Trans. Faraday Soc.*, **42 A**, 12–15; *disc.*, 36–9 (1946).—It is assumed that the action of a lattice and, for a liquid, of neighbouring molecules, on a dipole can be represented by a crystalline field. In opposition to Debye's and Fowler's assumptions, this field is not generally uniform because: (*a*) the interactions between molecules are not entirely of electrostatic origin, and (*b*) the charge distribution in the molecules must be taken into account. It is necessary to make a distinction not only between the electronic and the atomic polarization, and the orientation polarization, but also in the latter between an instantaneous orientation polarization (in every potential hollow) and a retarded polarization (involving transitions between hollows). Calculations are now made for a combination of the Mosotti–Lorentz–Debye hypotheses with that of the crystalline field, and also for combination with a modified Onsager theory. The results are not essentially different. H. H. HO.

537.226 2825

A contribution to the theory of the internal electrical field. BÖTTCHER, C. J. F. *Trans. Faraday Soc.*, **42 A**, 16–19; *disc.*, 36–9 (1946).—It is shown by a consideration of the internal field how the deviations from the formulae of Lorentz–Lorenz, Clausius–Mosotti, and Debye can be accounted for, viz. the dependence on the pressure of the molecular polarization of gases, and the dependence on the concentration of the molecular refraction of electrolytes in aqueous solutions. From the latter, the radii of the ions can be calculated. A formula, $\bar{F} = (\varepsilon + 2)E/3$ can be used for the calculation of the permittivity of a crystal from that of a crystalline powder. H. H. HO.

537.226 2826

A comparison of Debye's and Onsager's theories of the dielectric constants of concentrated polar media. FRANK, F. C. *Trans. Faraday Soc.*, **42 A**, 19–24; *disc.*, 36–9 (1946).—It is concluded that Debye's theory is the best extant for qualitative interpretation. In connection with the argument that any theory which permits the permittivity to pass to ∞ below a certain temperature is in fundamental disagreement with reality (an argument used for preferring the Onsager theory), the author points out that passage to ∞ signifies that the molecules become oriented without any applied field, i.e. the liquid crystallizes—a common occurrence in nature. The transition is usually abrupt, and passes directly to the solid rather than to a liquid crystal. The stable crystal form produced is more often non-polar than polar, and when polar it is only exceptionally reversible by an applied field as in Rochelle salt. All these facts find ready explanation on Debye's hindering energy theory. H. H. HO.

537.226 2827

Some mathematical models representing polar molecules in crystals. FRANK, F. C. *Trans. Faraday Soc.*, **42 A**, 24–35; *disc.*, 36–9 (1946).—Various restrictions on molecular orientation in a crystal, both with and without rotation, and having asymmetry in potential energy or statistical weight, are considered, and the resulting dependence of dielectric polarizability on temperature ascertained. When thermal co-operative effects are introduced, the models lead to 2nd- and 1st-order transitions, such as are observed. Electrical co-operative effects are discussed. Polar formations are favoured by molecules with greatest extension perpendicular to the dipole, by crystal structures containing lines of polar radicals, and by the special associative mechanism of the OH band (particularly in solutions at intermediate dilution, where solute molecules can associate in groups of some numbers). Such considerations indicate that it is hopeless to expect final accuracy from any "sphere-and-continuum" theory of dielectrics. H. H. HO.

537.226 2828

Note on the comparison of entropy and energy changes in diffusion and dielectric relaxation processes. LEVI, D. L. *Trans. Faraday Soc.*, **42 A**, 152–5; *disc.*, 155–69 (1946).—The activation energy and entropy terms associated with dielectric relaxation and water vapour diffusion in solids are shown to be capable of interpretation in terms of the molecular processes involved. Positive entropy changes are attributed to the occurrence of lattice disordering (hole-formation); negative changes are due to the requirement of a particular vibrational orientation by the molecule involved in either process. The suggested interpretation also accounts both for the observed magnitudes of the activation energy and for the linear relation between ΔE and ΔS. H. H. HO.

537.226 2829

On the application of dielectric measurements to chemistry. SUTTON, L. E. *Trans. Faraday Soc.*, **42 A**, 170–5; *disc.*, 193–4 (1946).—Polarization in a homogeneous material may be considered to arise in three ways: (*a*) By the deformation of electron distributions round atoms—called electron polarization; (*b*) by the displacement of charged atoms from their normal relative positions—called atom polarization; (*c*) by the change in average orientation of permanently dipolar molecules—called dipole orientation phenomena. Applications of dielectric measurements are considered under the above headings. Difficulties which remain imperfectly solved are: (i) how to allow for the solvent effect; (ii) how to compute the moments induced by a dipole in its near surroundings; (iii) how to measure the moments of individual bonds; (iv) how to predict accurately and from first principles the magnitude of the moment of a bond or molecule; these limit the scope of applications at present. H. H. HO.

537.226 2830

Molecular freedom in solid dielectrics. SMYTH, C. P. *Trans. Faraday Soc.*, **42 A**, 175–80; *disc.*, 193–4 (1946).—Some crystalline solids, glasses, viscous liquids and solid polymers show similar dielectric behaviour as the result of dipole orientation, the restriction of which is dependent upon molecular shape, packing in the lattice, and internal energy. The heats of transition and of fusion show that a solid phase below a rotational transition may differ more in energy from the phase above the transition than this rotating phase differs from the liquid. Freedom of molecular rotation as evidenced by a permittivity value $\geqslant$ (refractive index)^2 implies essentially the possession of sufficient molecular rotational energy to permit of frequent passage over restricting potential barriers. Intramolecular rotation or cumulative twisting about bonds may give dipole orientation in large molecules. Premelting and pre-rotation would seem to be the effects of the orientation of molecules here and there in the solid. As the effects increase in number, they co-operate to produce a rotational transition or fusion as the case may be. H. H. HO.

537.226 : 532.7 = 3 2831

Molecular structure of crystalline liquids: II. Dielectric anisotropy of ordered crystalline liquids of the type of *p* : *p*′-azoxyanisole. MAIER, W. *Z. Naturforsch.*, **2a**, 458–65 (*Aug.*, 1947) *In German.*—The dielectric anisotropies ($\Delta\varepsilon$) of 4 : 4′-di-*n*-alkoxyazoxybenzenes (A) < 0 whereas those of 4 : 4′-di-*n*-alkoxyazobenzenes > 0. In the crystalline state A gives values of $\Delta\varepsilon > 0$ owing to diminution in orientation polarization and in homologous series of A, $\Delta\varepsilon$ values vary with the number of C atoms in a way similar to melting pt. W. R. A.

537.226 : 539.13 = 3 *see Abstr.* 2895

537.226 : 539.133 *see Abstr.* 2899

537.226 : 539.153 = 3 *see Abstr.* 2904

537.226 : 548.0 2832

Domain structure and dielectric response of barium titanate single crystals. MATTHIAS, B., AND VON HIPPEL, A. *Phys. Rev.*, **73**, 1378–84 (*June* 1, 1948):—Single crystals were grown and investigated by means of the polarization microscope, X-ray diffraction, and their dielectric and piezoelectric response. It was possible to see the domains in the ferroelectric state and to change their number, size, and orientation. Wall displacements and the alignment of such domains, for which well-known indirect evidence exists in the case of ferromagnetics, were observed in both polarized and unpolarized light, and the influence of temperature and electric fields on the domain structure and orientation of the polar axis were investigated. In addition to the Curie point near 120°c, there exist two polymorphic transitions near 5°c and −70°c. A tentative explanation for the development of the ferroelectric state is given which brings the new ferroelectric group of the titanates into close relation to those of the tartrates and phosphates. A

537.226 : 548.73 2833

The permittivity of polycrystals of the perovskite type. RUSHMAN, D. F., AND STRIVENS, M. A. *Trans. Faraday Soc.*, **42 A**, 231–8; *disc.*, 244 (1946).—The main features of the dielectric polarization phenomena occurring in Ba titanate and the mixed Ba/Pb/Sr titanates are discussed. By postulating that the equilibrium position of the Ti ion in these compounds is displaced from the centre of the enclosing octahedron of O ions, the main features of the structure *v.* temperature and the permittivity *v.* temperature curves have been explained, and the existence of ferroelectric properties, which are associated with a tetragonal structure, is shown. H. H. HO.

537.226 : 548.73 *see Abstr.* 3007

537.228.1 : 537.531 : 548.0 *see Abstr.* 2979

537.228.1 : 548.0 = 3 283

Piezoelectricity and its relations. SPITZER, F. *Naturwiss.*, **34** (*No.* 2) 40–5; (*No.* 3) 76–80 (1947) *In German.*—A general introduction to the fundamentals of piezoelectricity is followed by a short review of the physical properties and applications of piezoelectric crystals, particularly Rochelle salt. H. J. H. S.

537.228.5 : 523.87 = 4 *see Abstr.* 2680

537.228.5 : 535.338 *see Abstr.* 2773–4

ELECTRIC CURRENTS 537.3

537.311.1.01 : 669 283

Theory of the influence of order-disorder transformation on the electrical resistivity in alloys. MATYÁŠ, Z. *Čas. Pest. Mat. Fys.*, **72** (*No.* 2) 79–94 (1947) *In English.*—An approximate wave-mechanical treatment of the dependence of the electrical resistance of $AuCu_3$ on the long-range (Bragg–Williams) order parameter gives good agreement ($\sim 10\%$) with experiment. A. J. C. W.

537.311.33 = 4 283

Discontinuities of potential between a metal and a liquid semi-conductor. ECK, J.-L. *C.R. Acad. Sci., Paris*, **225**, 1294–6 (*Dec.* 22, 1947) *In French.*—The passage of a current in a semi-conductor is often accompanied by apparent potential discontinuities at the electrodes. In the case of solids, Bodin and Déchène have shown that fallsi n potential could not be attributed to the formation of intermediate layers between the metal and the semiconductor. On the contrary, Sambussy claims that for liquids there is often produced an oxidation layer on the metal due to traces of residual moisture, which enables an explanation of the existence of the anodic drops in potential. From a series of experiments made with various electrodes of Zn, Al, Cu and Ta in acetone and nitrobenzene, the present author has confirmed Sambussy's hypothesis in the majority of cases. H. H. HO.

537.311.33 : 538.632 : 537.323 *see Abstr.* 2842

537.312.5 : 621.383.4 283

Spectral sensitivity of lead telluride layers. MOSS, T. S. Letter in *Nature, Lond.*, **161**, 766–7 (*May* 15, 1948).—The sensitivity was measured at the temperatures of solid CO_2, liquid O, and liquid H. The curves are approx flat but there is a sharp fall in sensitivity as the wavelengt increases. The thresholds of sensitivity, defined as th point at which this falls to 50% of its value over the fla

portion of the curve, were measured and found to be 4·1 μ at 195°K, 5·0 μ at 90°K and 5·9 μ at 20°K. L. S. G.

537.312.62 2838

On temperature dependence of penetration depth in superconductors. DE LAUNAY, J., AND STEELE, M. C. *Phys. Rev.*, **73**, 1450–4 (*June* 15, 1948).—By use of the Gorter–Casimir thermodynamic theory of superconductivity, the form of the Sommerfeld relation for the specific heat of electrons, and of the acceleration theory expression for penetration depth, the relative number of superconduction electrons and the relative penetration depth are derived as functions of the temperature. When the parabola relationship for threshold magnetic fields is used, comparison with experiment shows good agreement. In the limit of the absolute zero temperature, it is concluded that all of the normal conduction electrons become superconduction electrons in the absence of applied magnetic fields. The parabola relationship for threshold magnetic fields is discussed. A.

537.312.62 = 3 2839

On the theoretical significance of the experiments by Justi and Zickner on superconducting inductive networks. V. LAUE, M. *Z. Phys.*, **118** (*Nos* 7–8) 455–60 (1941) *In German.*—Calculations in connection with experiments [*Phys. Zeits*, **42**, 257 (1941)] on the basis of complete skin effect. From the fact that the experiments agree with theory it is concluded that the state of order in a superconductor is not influenced by an electric current. H. L.

537.312.62 = 3 2840

Remarks on the theory of superconductivity. SOMMERFELD, A. *Z. Phys.*, **188** (*Nos* 7–8) 467–72 (1941) *In German.*—It is shown that the relation between the magnetic threshold field at absolute zero and the critical temperature postulated by Welker from his electron theoretical model [Abstr. 797 (1939)] is in agreement with one that can be deduced from the thermodynamics of superconductors of Kok [Abstr. 444 (1935)] and Gorter and Casimir [Abstr. 2155 (1934)]. H. L.

537.32 : 532.13 : 536.75 *see Abstr.* 2820

537.322 : 538.63 2841

The application of Onsager's reciprocal relations to thermoelectric, thermomagnetic, and galvanomagnetic effects. CALLEN, H. B. *Phys. Rev.*, **73**, 1349–58 (*June* 1, 1948).—Analysis of the effects by means of the reciprocal relations leads to a simple and intuitive interpretation of the thermo-electric effects, provides a valid derivation of the Kelvin relations, and answers the long-standing question as to the existence of relations among the effects in a magnetic field. There exist two independent relations among the 8 commonly defined coefficients in a magnetic field—one of these relations having been previously given by Bridgman. The nature of the second relation is discussed. Also, certain general observations on the applicability of the Onsager relations to steady-state processes are discussed. A.

537.323 : 538.632 : 537.311.33 2842

The variation with vapour pressure of the properties of certain electronic semi-conductors. HOGARTH, C. A. *Phil. Mag.*, **39**, 260–7 (*April*, 1948).—Formulae are given for the variation of the Hall effect and the thermoelectric power. The agreement with experiment is good. L. S. G.

537.36 2843

Theory of the streaming potential. ELTON, G. A. H. Letter in *Nature, Lond.*, **161**, 847–8 (*May* 29, 1948).—See Abstr. 1562 (1948). A further 14 refs. are given in a short discussion.

537.362 : 626.86 : 621.359.2 2844

The application of electro-osmosis to practical problems in foundations and earthworks. CASAGRANDE, L. *Dep. Sci. Industr. Res.* (*Build. Res. Tech. Pap. No.* 30) 16 *pp.* (1947).—[Abstr. 2204 B (1948)].

537.363 2845

Separation of polar from non-polar molecules. KARAGOUNIS, G. Letter in *Nature, Lond.*, **161**, 855 (*May* 29, 1948).—Separation in the liquid form was effected, to the extent of 12% enrichment in the case of *p*-nitroaniline in benzene, by the application of non-uniform electric fields up to 10^6 V/cm.

ELECTRIC DISCHARGES AND RADIATIONS 537.5

537.521 : 538.566.2 : 523.74 : 621.396.61 2846

Spontaneous waves in discharge tubes and in the solar atmosphere. BAILEY, V. A. Letter in *Nature, Lond.*, **161**, 599–600 (*April* 17, 1948).—It is found theoretically that a strongly ionized gas with constant electric and magnetic fields is octuply refracting, with 8 possible types of wave. One or more of these types may show negative absorption, i.e. amplitude grows with time, and the gas should be capable of generating oscillations. The consequences of this possibility are briefly discussed.

537.523.3 2847

Positive and negative point-to-plane corona in air. ENGLISH, W. N. *Phys. Rev.*, **74**, 170–8 (*July* 15, 1948).—The present work has involved a careful comparison of positive and negative corona and observations at reduced pressures in the range 756 to 210 mm Hg. Oscillographic observation of corona pulses with a time resolution of the order of 10^{-7} sec, visual and photographic observation of the corona, and current-voltage measurements have thrown new light on fundamental corona processes. Some of the significant results obtained were as follows: For a polished Pt point of 0·38 mm diameter of curvature, the duration of positive pre-onset streamers and negative Trichel pulses near onset was $\sim 0{\cdot}4$ μsec; for positive breakdown streamers, 0·8 μsec. A comparison of positive and negative current-voltage characteristics showed that the intermittent onsets were approximately equal but showed a small pressure-dependent difference. Both curves showed linear Ohm's law regions, and the negative current was always the larger; these effects are due to space charge. The negative corona revealed the fluctuations and dependence on surface conditions noted by previous workers. A.

537.523.3 2848

Corona from a water drop. ENGLISH, W. N. *Phys. Rev.*, **74**, 179–89 (*July* 15, 1948).—Studies with a water drop point in a point-to-plane gap have yielded important results. Such a point has a very low secondary electron emission coefficient, and for the first time a large difference in positive and negative intermittent onset potentials in air, due to this, has been observed. The luminosity obtained with a negative drop point and the complex oscillograph pulses on both polarities have been accounted for by considering positive corona from charged droplets leaving the water point and assuming that true negative corona from a water surface is impossible. The space charge weakening of the field about a positive point, long assumed to explain the disappearance of the pre-onset streamers, is here confirmed by the reappearance of a stable drop point well above the initial potential required for disruption of the water surface. A.

537.523.3 = 82 2849

Mobility of ions under conditions of corona discharge. POPKOV, V. I. *C.R. Acad. Sci. URSS*, **58** (*No.* 6) 1043–6 (1947) *In Russian.*—A novel experimental method of electric field investigation during a corona discharge, employing probe technique, is described; tables and

curves, correlating corona voltage and current, atmospheric pressures, humidity and temperature, are presented. A. L.

537.523.4 2850

The role of the cathode surface in sparking phenomena. JACOBS, H., AND LAROCQUE, A. P. *Phys. Rev.*, **74**, 163–5 (*July* 15, 1948).—Experimental data related to the minimum sparking potentials of Ba, Mg and Al cathodes in He, Ne, A, Kr and Xe are summarized. The cathode material is found to play a major role in the sparking potential. Several applications are included. A.

537.523.4 : 545.822 2851

Reproducibility tests of sparking technique in laboratory practice. BHADURI, B. N. *J. Sci. Industr. Res.*, **66**, 55–6 (*April*, 1947).

537.523.5 : 621.325 = 3 2852

The radiation properties of modern Beck arcs. FINKELNBURG, W. *Optik*, **2**, 149–54 (*July*, 1947) *In German.*—A short review of recent German work on high current density carbon arcs between loaded electrodes. Current densities range from 100–300 A/cm², and the visible crater radiation may be $\sim 10\times$ that from low current density pure carbon arcs. The main physical properties of various forms of carbon arcs are tabulated. J. D. C.

537.525.3 = 3 2853

On the mechanism of secondary electron production in self-maintained Townsend discharges, especially in the case of coaxial cylinder electrodes. FETZ, H., AND MEDICUS, G. *Z. angew. Phys.*, **1**, 19–26 (*Jan.*, 1948) *In German.*—The general theory of various γ-mechanisms, as encountered in Townsend discharges, is discussed. New data for low-pressure discharges in H_2 and N_2 are provided. It is suggested that, whilst +ve ion collisions are important for high values of r_a/r_i (r_a = cyl. radius; r_i = wire radius), photo-ionization in the gas, caused by high energy photons produced in the avalanches, may be important for $r_a \simeq r_i$. J. D. C.

537.525.4 = 4 2854

Breakdown voltage in neon between caesium-covered electrodes. CUEILLERON, J. *C.R. Acad. Sci., Paris*, **226**, 400–1 (*Feb.* 2, 1948) *In French.*—Caesium was distilled on to electrodes composed of rings of Ni wire after careful vacuum treatment, etc. The min. breakdown voltage (50 c/s a.c.) was 64 V at 26 mm Hg press. for the particular electrode geometry specified. J. D. C.

537.525.8 2855

Probe measurements in a cold cathode argon glow discharge. I. JÖNSSON, T. *Trans. Chalmers Univ. Tech. Gothenburg* (*No.* 65) 18 *pp.* (1948) *In English.*—Gives a summary of probe theory, and results of experiments with A (10 mA current, 1–10 mm Hg pressure). Electron temps. were 16 000–24 000°K, with electron concentrations of $4{\cdot}5–6{\cdot}3\times10^8$/cm³. Ion temps. at these low concentrations were not considered reliable, if measured with probes in the manner described. J. D. C.

537.527.5 = 3 2856

On the deformation of the Hg high pressure d.c. arc by superimposed a.c. KOCH, B. *Ann. Phys. Lpz.* (*Folge* 5) **43** (*Nos* 1–2) 91–8 (1943) *In German.*—In a high-pressure Hg-vapour arc operated on d.c. a deformation was noted when an a.c. component was introduced. Tests on a 130 V, 1·9 A lamp showed the max. deformation when the frequency of superimposed a.c. was 3·7 kc/s. A single loop was caused by 0·3 A modulating a.c., and multiple loops by larger currents. The effect was observed over a frequency range of 3·4–4 kc/s, beyond which the magnitude of the a.c. required to cause arc deformation made arc operation impossible. A Heraeus lamp and a lamp without outer glass envelope were tried and found to have max. deformation effect at several frequencies. The results of tests were recorded by photo and tables shown in the paper. The phenomenon was more stable and reproducible with a horizontal than with a vertical lamp position. V. W. R.

537.527.5 = 3 285

On the theory of the heavy current arc column. SCHULZ, P. *Z. Naturforsch.*, **2a**, 662–6 (*Nov.–Dec.*, 1947) *In German.*—Discusses the energy balance in the arc column, i.e. the relative importance of radiation losses, thermal conduction and diffusion processes. The latter include the effects of diffusion of resonance radiation and loss of charged particles from the centre of the column. The effective heat conduction by electron movement is discussed, and shown to be important for high pressure arcs. J. D. C.

537.528 : 621.3.011.5 : 621.315.61 = 3 285

On the theory of electrical breakdown in liquids of simple structure. KRONIG, R. *Z. Phys.*, **118** (*Nos* 7–8) 452–4 (1941) *In German.*—Zener's theory of the electrical breakdown of solid dielectrics [Abstr. 1747 B (1934)] is considered to be applicable to dielectric liquids of simple structure. The extension to liquids is discussed on the basis of experimental data derived from measurements on liquid argon. R. D.

537.531 : 535.43 : 548.7 : 534.614 = 4 *see Abstr.* 2755

537.531 : 537.228.1 : 548.0 *see Abstr.* 2979

537.533 : 535.232 : 621.384.6 285

Radiation from electrons accelerated in a synchrotron. ELDER, F. R., LANGMUIR, R. V., AND POLLOCK, H. C. *Phys. Rev.*, **74**, 52–6 (*July* 1, 1948).—High energy electrons subjected to large radial accelerations radiate considerable energy in the optical spectrum. The distribution of energy in the light from a synchrotron beam has been measured and compared with theory at several electron energies up to 80 MeV. The results indicate reasonable agreement with theory. Measurement of total light output allowed an estimate of electron current in the beam. High speed photography of the light permitted observation of the size and motion of the beam within the accelerator tube. A.

537.533.8 = 3 286

The emission centres of the secondary electron emission of evaporated layers of alkaline metal carbonates. SUHRMANN, R., AND BERGER, W. *Z. Phys.*, **123** (*Nos* 1–2) 73–92 (1944) *In German.*—The carbonates of the alkaline metals Li, Na, K, Cs were evaporated in a high vacuum and condensed on an Ag base similarly obtained. The effect of thickness of deposit, additional deposits of similar or different metals, and the effect of O on the secondary electron emission was studied. The high secondary emission of condensation-deposited carbonate layers is found to be due to adsorbed alkaline metal atoms. The secondary electron yield falls if the layer is heated or oxidized. The yield can be restored by further deposit of alkaline metals, preferably Cs. The mechanism of secondary electron emission and the effect of adsorbed alkaline metal atoms is discussed. V. W. R.

537.534.72 = 3 286

Ultramicroscopy with ions. BÖRSCH, H. *Experientia* **4** (*No.* 1) 1–5 (1948) *In German.*—The possibilities of the investigation of atomic structure by means of ion beams instead of electron beams, are investigated. Since many of the required data were missing an experimental investigation was made. Resolving powers of about 500 Å were achieved with Li^+ ions. It is concluded that the perturbation of the object by the beam precludes better resolving powers being obtained. A. H. W. B.

537.534.74 : 539.152.1 *see Abstr.* 2901

537.534.74 : 621.384.6 2862

Scattering of particles by the gas in a synchrotron. BLACHMAN, N. M., AND COURANT, E. D. *Phys. Rev.*, **74**, 140–4 (*July* 15, 1948).—Successive elastic encounters of a proton with atoms of air in a proton synchrotron may build up a betraton oscillation whose amplitude exceeds the aperture of the vacuum chamber; in this case the particle is lost. The Rutherford scattering formula, suitably cut off at large and small scattering angles, is used to determine the r.m.s. amplitude of this oscillation as a function of the increasing kinetic energy of the particle. It reaches a maximum when the latter is four times its value at injection. The differential equation, which the distribution of amplitudes as a function of path length must obey, is solved by use of appropriate boundary conditions, for the case in which damping of the oscillations is ignored. The solution makes possible an estimate of the fraction of the original particles which is scattered to the wall. These results are applied to two proposed synchrotrons to determine the air pressures which give a 10% loss of particles. A.

537.542 = 3 2863

A sensitivity effect of u.v. counters. LAUTERJUNG, K. H. *Naturwiss.*, **34** (*No.* 4) 120–1 (1947) *In German.*—After intense irradiation of a counter with γ-rays, an after-effect of increased sensitivity was found which disappeared in ~ 12 min. However, with u.v. light in place of the γ-rays, the effect was greatly increased and recovery after 4–5 min took place according to a law of the form $S \propto t^{-\alpha}$, where $\alpha \leqslant 2$, and S is a ratio representing the sensitivity increase. The equation suggests a bimolecular recombination process [Abstr. 1625 (1939)]. The dependence of the effect on the time of exposure is also investigated. R. W. P.

537.561 2864

On the ionization potentials of the *K* and *L* electrons. RICHTER, A. F. *Phil. Mag.*, **39**, 303–14 (*April*, 1948).—A continuation of previous work [Abstr. 1108 (1932)], on the conjugation of unsaturated groups of electrons, atoms or molecules. The ionization potentials, I, of the K and L isoelectronic rows form an arithmetical progression, and the differences between I for 2 corresponding members in 2 isoelectronic rows also form an arithmetical progression. The constants appearing in these progressions are studied. L. S. G.

537.566 : 621.43.04 : 536.46 = 4 *see Abstr.* 2816

537.582 2865

The thermionic properties of chromium. WAHLIN, H. B. *Phys. Rev.*, **73**, 1458–9 (*June* 15, 1948).—The spectral emissivity, the temperature scale, and the electron work function of chromium have been determined. The emissivity is found to be 0·334 for a wavelength of 6 690 Å and the value found for the electron work function is 4·60 V with an A for Richardson's equation of 48 A/cm^2/T^2. A.

COSMIC RAYS 537.591

537.591 2866

Mass temperature coefficients of cosmic-ray components. MILLICAN, F. M., AND LOUGHRIDGE, D. H. *Phys. Rev.*, **74**, 66–70 (*July* 1, 1948).—The temperature-pressure curve from U.S. Navy Raob data was integrated by an empirical formula determined graphically. The resulting average "mass temperature" of various fractions of the atmosphere was correlated by a method of least squares with the vertical cosmic-ray intensity of three components; hard, medium, and soft, shielded by 30·5, 20·5 and 0·5 cm of lead, respectively. The temperature coefficient was found to be an increasing function of the fraction of the atmosphere for larger fractions. The temperature coefficients calculated are quoted. A.

537.591 : 535.234 = 3 2867

The source of cosmic rays. JORDAN, P. *Nachr. Wiss. Göttingen* (*No.* 1) 42–4 (1945) *In German.*—A modification of the Planck radiation formula is considered which would allow the known high energies of primary cosmic rays (up to 10^{16} eV) to be derived from eruptions of the Supernovae type. J. G. W.

537.591 : 537.122 = 5 2868

The influence on cascade processes of pair production in the Coulomb field of the electrons. CLEMENTEL, E., AND PUPPI, G. *Nuovo Cim.*, **4**, 277–8 (*Oct.*, 1947) *In Italian.*—Given the cross-section σ_0 for pair production in the field of the nucleus in a medium of atomic number Z, an additional term, due to pair production in the electron shells, is introduced, and the total cross-section shown to be $\sigma_0(Z + 1)/Z$. The position of the maximum of the electron cascade is then recalculated. The correction is too small to be detected experimentally. G. P. S. O.

537.591 : 539.17 = 4 2869

A large cosmic ray star produced at sea-level. CÜER, P., MORAND, M., AND MOUCHARAFYEH, H. *C.R. Acad. Sci., Paris*, **226**, 713–15 (*March* 1, 1948) *In French.*—A star of 18 visible branches produced at sea level by cosmic rays is discussed. The visible fast particles carry about 28 electronic charges, and it is likely that a fairly complete disintegration of a Br nucleus has taken place. J. G. W.

537.591 : 539.172 = 3 2870

On the mechanism of high energy nuclear processes in cosmic rays. SCHOPPER, E. Letter in *Naturwiss.*, **34** (*No.* 4) 118–19 (1947) *In German.*—A nuclear disruption recorded at high altitude in a photographic emulsion is described, in which the track-forming particles come from two closely connected but distinct centres. The event is interpreted as the emission at the primary disintegration of a heated C nucleus, which in turn evaporates after a further time of $\sim 10^{-13}$ sec. J. G. W.

537.591 : 539.172 = 5 *see Abstr.* 2937

537.591.1 2871

A doubly charged cosmic ray particle. SAHIAR, A. B. Letter in *Nature, Lond.*, **161**, 811–12 (*May* 22, 1948).—Of over 1 000 cloud chamber photographs of mesons, one was obtained showing several cascades produced by electrons in a 2 cm Pb plate inside the chamber. These were accompanied by penetrating particles which passed through the plate without appreciable deflection. There was also a thick track emerging from the bottom of the Pb plate. It was conjectured that this was due to a highly ionizing doubly charged particle. Evidence for this is given. L. S. G.

537.591.1 2872

Cosmic-ray investigations on Mt. McKinley. CARR, T. D., SCHEIN, M., AND BARBOUR, I. *Phys. Rev.*, **73**, 1419–23 (*June* 15, 1948).—Three cosmic-ray experiments were carried out at an altitude of 18 100 ft. The first experiment measures the absorption curve of penetrating particles in Pb thicknesses up to 50 cm. A large number of slow mesotrons of energies around 200 MeV was found. From the measured mesotron energy spectrum a calculation was made to determine the spectrum which would be anticipated at 14 250 ft. The result is compared with experimental data obtained on Mt. Evans. The discrepancy between the two curves strongly indicates that an additional production of mesotrons of energies less than 400 MeV takes place in the atmosphere between these altitudes. The other two experiments at 18 100 ft

investigate the production of penetrating particles by ionizing and non-ionizing radiation in lead and paraffin. A.

537.591.1 2873

Experiments on the separation of low energy mesotrons from electrons. BHATTACHARYA, P. C. *Phys. Rev.*, **74**, 38–43 (*July* 1, 1948).—A block of Pb 1·25 cm thick was placed above a pair of anticounters such that any electron which generates a shower in it is removed by the anticounters. An additional block was also placed below the anticounters to absorb any electron which escaped the system without producing a shower in the upper Pb piece. The mesons thus separated from the electrons were examined in a Wilson chamber having a 2 cm block of Pb across the centre. 937 single tracks were observed to traverse the block and all these tracks were ascribed to mesons. There was a case of a shower of three particles found to be generated in the Pb inside the chamber, and attributed to a knock-on process. It was also found that the thickness of the additional lead block could be reduced to 2 cm at sea level without disturbing the efficiency of the system. By an experiment with counters it was also found that 1·25 cm of Pb corresponds to the maximum for showers of two or more particles initiated only by electrons in Pb. A.

537.591.15 2874

On the analysis of extensive cosmic-ray shower data. LEWIS, H. W. *Phys. Rev.*, **73**, 1341–5 (*June* 1, 1948).—Formulae are derived, on the basis of the primary electron hypothesis, which describe the behaviour of counters exposed to the large air showers. Expressions for the variation of counting rate with area of the counters, number of counters and altitude are given, and these agree fairly well with experiment, except for at very high altitudes. A.

537.591.15 2875

On the penetrating showers of cosmic radiation. COCCONI, G., AND GREISEN, K. *Phys. Rev.*, **74**, 62–5 (*July* 1, 1948).—Experiments have been performed on the penetrating showers of cosmic radiation accompanied and not accompanied by extensive air showers. In the accompanied showers the penetrating particles are very likely to pre-exist in the air; in the unaccompanied showers they are created in the absorbers surrounding the counters by a nucleonic component of the cosmic radiation. A.

537.591.5 2876

The directional intensity of cosmic rays at several altitudes. SANDS, M. *Phys. Rev.*, **73**, 1338–40 (*June* 1, 1948).—The vertical intensity and the intensity at inclined directions of the ionizing cosmic rays which penetrate 5 g-cm^{-2} of brass were measured with a counter telescope at several altitudes between sea level and 10 700 m. A.

537.591.8 = 5 2877

On the production of mesons in the lower atmosphere. ADDARIO, M., AND COCCONI, G. *Nuovo Cim.*, **4**, 212–20 (*Oct.*, 1947) *In Italian.*—The discrepancies between the values found for the mean life time of the meson are attributed to the production of mesons in the different materials used as the equivalent air thickness. The number of mesons produced is found to $\propto 1/Z^2$ where Z is the atomic number of the absorber. Experiments carried out at sea level using absorbers of Pb and of water show good agreement with this theory. G. P. S. O.

537.591.8 = 5 2878

On the production of mesons in proton-proton collisions in cosmic rays. CLEMENTEL, E. *Nuovo Cim.*, **4**, 221–6 (*Oct.*, 1947) *In Italian.*—Heitler's theory of meson production in proton-proton collisions has been used to determine the number of mesons produced in further collisions by protons recoiling with sufficiently high energy. G. P. S. O.

537.591.8 : 539.172 2879

Anomalous distribution of nuclear disintegration in photographic emulsions exposed to cosmic rays: double stars. LEPRINCE-RINGUET, L., AND HEIDMANN, J.; LI, T. T., AND PERKINS, D. H. Letter in *Nature, Lond.*, **161**, 844–5 (*May* 29, 1948).—I. Out of 2 250 stars examined, a number much exceeding the probable were found to be closely situated pairs. Assuming that the second star of a pair is caused by a "trackless" particle emitted from the first, an estimate of its cross-section was made. This is $(7\cdot5/b)\times10^{-24}$ cm^2, where b = number of trackless particles emitted; this is likely to be 5–10, giving a cross-section in accord with that of neutrons. II. Perkins reports very similar results, but he gives reasons for believing b to be smaller, and neutrons to be responsible for only a fraction of the secondary disintegrations.

MAGNETISM 538

538 : 530.12 = 4 *see Abstr.* 2696

538.082.1 : 532.65 = 4 2880

Determination of magnetic susceptibility and coefficient of magnetization of liquids and solutions by a stalagmometer method. GUILBERT, A., AND CARA, M. *C.R. Acad. Sci., Paris*, **226**, 647–8 (*Feb.* 23, 1948) *In French.*—When the fall of drops formed on a stalagmometer placed in an intense magnetic field with markedly curved lines of force is studied, it is found that frequency of fall and the weight of the drops are affected by field strength. An expression is derived on the basis of Tate's law connecting the change in weight of the drop with its susceptibility, the field strength, and the radius of curvature of the field. Extensions and limitations of the method are briefly reviewed. W. R. A.

538.1 : 530.145 *see Abstr.* 2717

538.214 : 541.128.5 : 541.183 2881

Catalytic poisons and magnetic susceptibilities. DILKE, M. H., ELEY, D. D., AND MAXTED, E. B. Letter in *Nature, Lond.*, **161**, 804 (*May* 22, 1948).—Results of some preliminary measurements on the change in magnetic susceptibility of Pd due to adsorption of dimethyl sulphide. The conclusion is that electrons from the S atom enter the *d*-band of the metal. L. S. G.

538.222 : 548.7 *see Abstr.* 2999

538.224 2882

Diamagnetic susceptibility of lead ion. PRASAD, M., DHARMATTI, S. S., AND KHANOLKAR, D. D. *Proc. Indian Acad. Sci. A*, **26**, 328–38 (*Nov.*, 1947).—Twelve inorganic and nine organic salts of lead were measured in the solid state and the value for the Pb ion is deduced and compared with calculated values. W. R. A.

538.24 : 621.3.013 = 4 2883

Intensity of magnetization. BRYLINSKI, E. *Rev. Gén. Élect.*, **57**, 82–6 (*Feb.*, 1948) *In French.*—Rejects the definition of intensity of magnetization as volume density of magnetic moment, considers the whole problem in terms of magnetic fields and concludes that the classical concept of magnetic bodies should be abandoned. N. F. A.

538.247.081.5 = 5 2884

Some considerations on the units of magnetic quantities and on the formula for the demagnetization coefficient. CHIODI, C. *Elettrotecnica*, **31**, 39 (*Feb.* 10–25, 1944). *Pubbl. Ist. Elettrotec. Naz. Galileo Ferraris* (*No.* 161) *In Italian.*—The various systems of units in use, and the confusion which arises because some quantities are of

different dimensions in different systems and there is no unique transformation factor, are discussed. The case of the demagnetization coefficient is considered especially and the formula $H_i = H_e - NJk_m/4\pi$ for the internal field of a magnetized body with demagnetization coefficient N is proposed. J. A. W.

ELECTROMAGNETISM
ELECTRODYNAMICS 538.3/.5

538.3 = 3 2885

Electric field mechanics. FLAMM, L. *Acta Phys. Austriaca*, **1** (*No.* 2) 259–84 (1948) *In German.*—With every elementary electric charge there is associated an elementary electric field. This field possesses elasticity and inertia and forms a kind of matter, called "field-matter," with properties similar to those of material particles. The properties of this field-matter are investigated. Formulae for the kinetic energy and impulse are discussed and the equations of electrodynamics are derived. L. S. G.

538.3 = 4 2886

The electromagnetic field of a charge in motion. DURAND, E. *Cah. de Phys.* (*Nos* 31–2) 75–82 (*Jan.*, 1948) *In French.*—The field potentials are developed in a series by a method due to Reulos, depending on the actual rather than the retarded position of the charge. It is proved equivalent to the usual retarded field, and applied to a system of neighbouring point charges. G. J. K.

538.3 : 531.51 : 530.12 = 4 *see Abstr.* 2695

538.566 : 535.223 : 621.396.611.4 2887

The velocity of propagation of electromagnetic waves derived from the resonant frequencies of a cylindrical cavity resonator. ESSEN, L., AND GORDON-SMITH, A. C. *Proc. Roy. Soc. A*, **194** (*No.* 1038) 348–61 (1948).—The frequency of resonance of an evacuated cavity resonator in the form of a right circular cylinder is given by the formula $f = v_0\sqrt{[(r/\pi D)^2 + (n/2L)^2][1 - 1/2Q]}$ in which v_0 is the free-space velocity of electromagnetic waves, D and L are the internal diameter and length respectively of the cylinder, r is a constant for a particular mode of resonance, n is the number of half-wavelengths in the resonator and Q is the quality factor. Assuming the validity of this equation the value of v_0 can be obtained from measured values of f, D, L and Q. A Cu cylinder of diameter $\sim 7{\cdot}4$ cm and length $8{\cdot}5$ cm was constructed with the greatest uniformity of diameter and squareness of end-faces and its dimensions were measured. The resonant frequencies for a number of different modes were measured and experiments were made to show that the effects on frequency of the coupling probes to the oscillator and detector were negligibly small. It was concluded from these measurements that the most favourable experimental conditions can be obtained for the $E_{01\theta}$ and E_{011} modes. Final measurements on these gave $v_0 = 299\,792$ km/sec. The estimated maximum error of the result is 9 km/sec (3 parts in 10^5). The value is 16 km/sec > the recently determined values of the velocity of light, although the results are not in disagreement when the combined limits of accuracy are taken into account. A.

538.566 : 621.396.11 2888

Radio-wave propagation and electromagnetic surface waves. EPSTEIN, P. S. *Proc. Nat. Acad. Wash.*, **33**, 195–9 (*June*, 1947).—The discrepancy between Sommerfeld's [Abstr. 1181 B (1909)] and Weyl's [Abstr. 417 (1918)] treatment of propagation, giving surface waves in the former, but not in the latter case, is resolved by pointing out a second solution to Sommerfeld's equation. The surface waves are shown to exist, but are not a part of the radiation of the generating dipole and are not generated by it.

538.566.2 : 523.74 : 621.396.61 : 537.521 *see Abstr.* 2846

MAGNETIC EFFECTS 538.6

538.63 : 537.322 *see Abstr.* 2841

538.632 : 537.311.33 : 537.323 *see Abstr.* 2842

538.652 = 4 2889

Static measurements of magnetostriction in austenitic iron-nickel alloys. DEVÈZE, H. *C.R. Acad. Sci., Paris*, **226**, 727–9 (*March* 1, 1948) *In French.*—Measurements of magnetostriction as a function of induction show that the slope of the (dl/l) v B curve has a maximum, the magnitude of which varies with the composition of the alloy. This information is of use in the design of magnetostrictive oscillators. A. E. DE B.

538.652 : 621.318 2890

Magnetostriction generators. OSBORN, J. A. *Elect. Engng, N.Y.*, **67**, 571–8 (*June*, 1948).—[Abstr. 2184 B (1948)].

ATOMIC AND MOLECULAR STRUCTURE 539

539.11 2891

The ratio of valence electrons to atoms in metals and intermetallic compounds. PAULING, L., AND EWING, F. J. *Rev. Mod. Phys.*, **20**, 112–22 (*Jan.*, 1948).—The metallic valences proposed for the elements K to Zn on the basis of their magnetic properties [Abstr. 385 (1939)], in conjunction with modified Brillouin zones, give a rather better explanation of alloys with the α, β, γ, and ε structures than those originally employed in formulating the Hume–Rothery rules. For example, the zone bounded by {600} and {442} corresponds to a number of electrons per unit cell within $1{\cdot}5\%$ of that calculated from the new valences and the observed composition of the γ structure, whereas on the basis of the zone bounded by {330} and {411} and the old valences the difference is $6{\cdot}5\%$. A. J. C. W.

539.13 2892

The dielectric polarization and molecular association of hydrogen fluoride vapor. ORIANI, R. A., AND SMYTH, C. P. *J. Amer. Chem. Soc.*, **70**, 125–30 (*Jan.*, 1948).—Permittivity measurements and dipole moment calculations have established that HF forms polar, approx. linear, polymers. The dielectric polarization has been measured as a function of pressure at different temps. from $23{\cdot}1°$ to $59{\cdot}7°$C. At higher pressures and low temp., molecular association is exhibited by various linear structures of high dipole moment. With increasing pressure and decreasing temp., the fraction of associated molecules increases, and the data suggest that cyclic structures (in equilibrium with the linear polymers) are also formed to an extent which depends on increase of pressure and decrease of temp. W. R. A.

539.13 2893

Note on the stability of systems containing a light positive particle. ORE, A. *Phys. Rev.*, **73**, 1313–17 (*June* 1, 1948).—The dynamic stability of atomic or molecular systems which contain a positron, e.g. e^+Cl^-, are considered. Information is obtained from experimental data descriptive of hydrides and of the H_2 molecule or molecular ion, and existing calculations of the energy of light polyelectrons. The first procedure suffices to guarantee stability only when the positron is

replaced by a positive meson which has a mass of the order of 20 electron masses or more. The second procedure allows a certain lowering of these approximate minimum mass values, in a special case to a few electron masses. The various numerical results are obtained very easily. They indicate that negative atomic ions can have a positive positron affinity. A.

539.13 : 535.338.4 2894

High energy states of N_2^+ and N_2. SETLOW, R. B. *Phys. Rev.*, **74**, 153–62 (*July* 15, 1948).—The rotational structure of the $C - X$ bands of N_2^+ has been analysed. A rotational perturbation appears in the $v = 0$ level of the C state. Evidence is presented against postulating a vibrational perturbation in the $v = 0$, $v = 1$ levels of this state. Construction of potential curves using the new rotational data shows that previous assignments of vibrational levels are incorrect. A new vibrational numbering is proposed, which is in conformity with the Franck-Condon principle. The use of the Franck–Condon principle in predicting intensities in collisions of the second kind has been verified. Measurement of the rotational structure of the $c - X$ bands of N_2 shows that the c state is the $v = 1$ level of the b' state. The vibrational analysis confirms this identification, as does the intensity distribution. Perturbations between states p' and b' are discussed. Evidence is cited to show that the c state of Worley is identical with the p' state of Gaydon. A.

539.13 : 537.226 = 3 2895

Molecules with very small electrical relaxation times. FISCHER, E. Letter in *Naturwiss.*, **33**, 368–9 (*Dec.* 30, 1946) *In German.*—If substituent groups in benzene derivatives are capable of rotating, the electrical relaxation time will become very small, particularly if the *p*-position is involved. Experimental evidence in support has been presented through measurements on the dielectric loss for meter waves in respect of aniline, *o*-, *m*-, and *p*-toluidine, *p*-phenylenediamine, and benzidine. W. R. A.

539.132 2896

Notes on the molecular orbital treatment of linearly coupled systems. COULSON, C. A., AND RUSHBROOKE, G. S. *Proc. Cambridge Phil. Soc.*, **44** (*Pt* 3) 272–9 (1948).—The allowed energy, E, of the system is obtained by solving a type of determinantal equation. The mathematical method permitting a solution is developed. It generalizes an earlier result [Abstr. 905 (1938)]. Application is made to a chain of atoms, which may be an insulator or a conductor, and some problems on polyene chains with alternating links [Abstr. 435 (1937)] may be treated by the method given. L. S. G.

539.132 2897

Interconversion of ortho- and para-deuterium due to the deuteron quadrupole moment. HAMERMESH, M. Letter in *Phys. Rev.*, **73**, 638–9 (*March* 15, 1948).—According to calculations by Casimir [Abstr. 926 (1940)] the effect of the interaction of an inhomogeneous electric field with the quadrupole moment of the deuteron gives a large contribution to the rate of $o - p$ interconversion of D_2 in H_2O. The total conversion rate calculated on this basis is in good agreement with experiments by Farkas and Sandler [Abstr. 1398 (1939)]. The present author points out that there is an error in Casimir's calculations, the correction of which reduces the quadrupole effect by a factor 5. It is, however, believed that in spite of this the interconversion in diamagnetic materials is mainly due to the quadrupole effect. It is suggested that the interconversion rate of D_2 in D_2O and other dipole substances should be measured, where it should depend quadratically on the dipole moment of the catalysing molecule. H. L.

539.132 : 532.7 = 4 *see Abstr.* 2743

539.132 : 541.57 = 4 289

On a new method in molecular structure. DAUDEL, R. *C.R. Acad. Sci., Paris*, **226**, 175–7 (*Jan.* 12, 1948) *In French.*—A method is given of defining bond strength in molecules, and the free valence of atoms, which can be used to give bond lengths and other molecular magnitudes in the usual way. G. J. K.

539.133 : 523.77 = 4 *see Abstr.* 2669

539.133 : 535.338.3 *see Abstr.* 2776

539.133 : 537.226 289

A new method of determining the relaxation time and the dipole moment of polar substances; its application to fatty acids. POTAPENKO, G., AND WHEELER, D., JR. *Rev. Mod. Phys.*, **20**, 143–50 (*Jan.*, 1948).—The permittivity and the coefficient of anomalous absorption of dilute solutions of polar substances in non-polar solvents have been measured at constant frequency near the maximum of anomalous absorption as a function of concentrations. Solutions of formic, acetic, propionic and *n*-butyric acid in dioxan have been investigated and from the relaxation time data, the volume of the particle which has become oriented by the impressed electric field has been calculated. Since these calculated volumes ∝ the molecular volumes, it appears that the anomalous absorption of ultra-high frequencies in fatty acids arises from the orientation of the whole molecule as a unit, and thus the polar carboxylic group cannot be oriented independently of the rest of the molecule. Calculated values for dipole moments are in good agreement with recorded values, thus providing support for the validity of the relaxation time data. W. R. A.

539.152.1 290

The radial dependence of the tensor force in the deuteron. GUINDON, W. G. *Phys. Rev.*, **74**, 145–9 (*July* 15, 1948).—The properties of the deuteron are discussed by means of a *n-p* potential consisting of but two terms: ordinary force and tensor force, with different radial dependences. Assuming the latter to be square wells of different ranges, the wave functions corresponding to selected pairs of radii for the ordinary and tensor wells are computed, and from these the quadrupole moment is calculated. In summary, the results indicate that (*a*) no special pair of ranges appears preferred in the light of scattering experiments of the comparison between observed and calculated magnetic moments, (*b*) the binding energies of heavy nuclei apparently limit the ordinary force range to about $(2{\cdot}6 \pm 0{\cdot}1) \times 10^{-13}$ cm, and (*c*) all empirical data may be fitted, within experimental error, by a very simple potential with equal ranges: $-[1 + S_{12}]J(r)$, with $J(r)$ a square well of depth 13·25 MeV, and of radius $2{\cdot}663 \times 10^{-13}$ cm. A.

539.152.1 : 537.534.74 290

Proton-proton scattering at 7 Mev. DEARNLEY, I. H., OXLEY, C. L., AND PERRY, J. E., JR. *Phys. Rev.*, **73**, 1290–1306 (*June* 1, 1948).—Experiments were performed with protons from the cyclotron scattered in H gas. Photographic plates were used in a camera which recorded simultaneously individual protons scattered at angles from 10·5° to 45°. 5000 tracks were counted in each of nine narrow angular ranges to give good statistical accuracy. An experimentally determined correction was necessary due to proton penetration of the edges of the slits which admitted scattered protons to the photographic plates. The energy of the protons was determined by magnetic deflection and from ionization ranges. Analysis

of the results shows an *s* phase shift somewhat lower than that predicted by extrapolation of the earlier low energy data as analysed in terms of square well, Gauss, and meson potentials. On the assumption of central *p*-wave scattering the results are fitted by a *p*-phase shift of $-0{\cdot}22°$, which corresponds to scattering from a repulsive square well with interior Coulomb potential, range e^2/mc^2 and height 2·2 MeV. Extending the Rarita–Schwinger neutron-proton interactions to the proton-proton system for a prediction of tensor ^3P wave scattering, it was found that the experimental results are reconcilable with the "symmetrical" and with the "charged" theory. The "neutral" theory gives ^3P scattering in definite disagreement with the experimental results. A.

539.152.1 : 539.163.2 *see Abstr.* 2919

539.152.1 : 539.18 *see Abstr.* 2946

539.152.2 2902

The magnetic exchange moment for He^3 and H^3. ANDERSON, H. L. Letter in *Phys. Rev.*, **73**, 919–20 (*April* 15, 1948).—The recently measured nuclear magnetic moments of H^3 and He^3 [Abstr. 1592–3 (1947)] are most reasonably interpreted on the assumption that part of the moment (0·27 nuclear magneton) is caused by magnetic exchange currents (+ for H^3, − for He^3) [see Abstr. 3284 (1947)] the admixture of ^2P, ^4P and ^4D eigenfunctions being as proposed by Gerjuoy and Schwinger [Abstr. 1605 (1942)].

539.152.2 : 537.133 = 4 2903

A classical model for the proton. WISNIEWSKI, F. J. *C.R. Acad. Sci., Paris*, **223**, 274–6 (*Aug.* 5, 1946) *In French.*—The model proposed consists of a sphere with uniform surface charge density rotating uniformly. The magnetic moment is calculated to be $\mu = \frac{5}{3}ik$ (i = spin; $k = 5\times10^{-24}$ c.g.s. units). The experimental value is $2{\cdot}6\,k$; putting $i = \frac{3}{2}$ in the above gives $\mu = 2{\cdot}5\,k$. Alternatively, if the magnetic moment is assumed to be $\mu = \frac{5}{3}ik + \mu_n$ (μ_n = neutron moment) the value $\mu = 2{\cdot}667\,k$ is obtained by putting $i = 1$, $\mu_n = k$. L. S. G.

539.153 : 537.226 = 3 2904

A perturbation calculation in the extended statistical theory of atoms and its application to the calculation of polarisabilities. GOMBÁS, P. *Z. Phys.*, **122** (*Nos* 5–8) 497–509 (1944) *In German.*—Using the statistical theory with a variable parameter in the electron density, a 2nd-order perturbation calculation is made of the energy in an applied electric field. This needs the 1st-order change in the electronic distribution. It is then minimized with respect to the parameter. The result is used to calculate polarizabilities for rare gas atoms and alkali and alkali-earth ions. The values are in better agreement with experiment for the heavier atoms, as would be expected. G. J. K.

539.154.2 : 521.042 = 4 2905

On the origin of atomic nuclei. WATAGHIN, G. *C.R. Acad. Sci., Paris*, **226**, 633–5 (*Feb.* 23, 1948) *In French.*—Investigates the effect of the gravitational field upon the formation of elements in the interior of a star. R. A. N.

539.155.2 = 3 2906

The phenomena of separation processes. KLEMM, A. *Z. Phys.*, **123** (*Nos* 1–2) 10–27 (1944) *In German.*—It is shown that basically the phenomena in the separation of isotopes by gravitation, heat, diffusion and electric fields can be expressed in terms of the material diffusion and separation constants and the separation force or potential. A critical examination of the various processes in use reveals that with single-stage separation only the electric field is capable of producing any desired degree of separation. In centrifuge, thermodiffusion and diffusion processes the degree of separation beyond a certain limit can be increased only by the counterflow principle. Formulae for the possible degree of separation with the various processes are developed and discussed. V. W. R.

539.155.2 = 3 2907

On the relative abundance of the lithium isotopes. HINTENBERGER, H. Letter in *Naturwiss.*, **34** (*No.* 2) 52 (1947) *In German.*—The ratio $Li^7 : Li^6$ found with a mass spectrometer, using ions obtained by evaporation of Li metal, is criticized because Li^6 tends to vaporize $\sqrt{(7/6)}$ times as fast as Li^7. Measurements of the apparent ratio are reported, using Li ions (*a*) from evaporated Li. (*b*) from evaporated LiCl; the values are $11{\cdot}6 \pm 0{\cdot}2$ and $12{\cdot}4 \pm 0{\cdot}2$ respectively. It is suggested that the true ratio is between $12{\cdot}4 \pm 0{\cdot}2$ and $12{\cdot}52 \pm 0{\cdot}2$. A. P. F.

539.155.2 : 535.338.333 2908

Molecular spectroscopic evidence of the existence of strontium isotopes Sr^{88}, Sr^{87}, and Sr^{86}. AHRENS, L. H. *Phys. Rev.*, **74**, 74–7 (*July* 1, 1948).—An analysis of certain heads of the sequence $v' - v'' = +1(^2\Sigma \rightarrow {}^2\Sigma)$ in SrF arc emission spectra, revealed three components at each of the first heads, the displacements of which show the presence of three Sr isotopes at masses 88, 87, and 86. A quantitative determination of the abundance ratio 88 : 86 gave a value of 8·52, which is in reasonably good agreement (+ 2·0%) with the abundance ratio of 8·38 determined mass spectrographically. Abundance ratios 88:87and 87:86 could be determined only approximately because of masking of the $Sr^{87}F$ component by the dominant $Sr^{88}F$ component. The spectra had been recorded using 1st-order (dispersion, 0·848 Å/mm), but if 2nd-order were used, this masking would be reduced to an insignificant amount. For geological age requirements, mass-spectrographic measurement of Sr isotope abundance ratios is preferable because as little as 0·3 mg of Sr salt is required, whereas using molecular spectra, far larger amounts are required. A.

539.155.2 : 541.23 = 3 2909

The relative isotopic abundances and the atomic weights of copper and ruthenium. EWALD, H. *Z. Phys.*, **122** (*Nos* 5–8) 487–93 (1945) *In German.*—Ions of the element under study and of a comparison element (of known isotopic composition) were produced simultaneously in a mass spectrograph, and the various isotopic lines were recorded on a photographic plate and measured photometrically. By adjustment of relative concentration of the two elements, the lines under study could be made to lie within the range of blackening of the comparison lines. Cu was compared with Zn and Kr, Ru with Cd. Atomic weights were calculated from the isotopic compositions. A. P. F.

539.155.2 : 542.48 2910

The approach to equilibrium in fractionation. BARTKY, W., AND DEMPSTER, A. J. *Rev. Mod. Phys.*, **20**, 123–8 (*Jan.*, 1948).—The differential equations for a plate column are solved for cases that arise in the concentration of isotopes, where there is a small difference in the concentration in the liquid and gas phases, or where the equilibrium constant for ion exchange is very nearly unity. A formula suitable for computation is deduced, and curves are given showing the rate of approach to equilibrium for various numbers of plates. A.

539.155.2 : 542.48 2911

Fractional distillation and its application in the concentration of the heavy isotopes of oxygen and hydrogen. DOSTROVSKY, I., HUGHES, E. D., AND LLEWELLYN, D. R. Letter in *Nature, Lond.*, **161**, 858–9 (*May* 29, 1948).—

[See Abstr. 2689 (1946)]. A new column, 30 ft high, 3 in dia, is described, and some results of its operation are quoted.

RADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

539.163 2912

On the radioactivity of potassium. MEYER, H. A., SCHWACHHEIM, G., AND SOUZA SANTOS, M. D. *An. Acad. Brasil Cienc.*, **19** (*No.* 2) 189–92 (1947) *In English.*—A γ-ray energy of 1·5 MeV was obtained in absorption experiments. As no evidence for coincidences between β^- particles and γ-quanta could be found, it is assumed that the γ-radiation is associated with the *K*-capture transition $K^{40} \rightarrow A^{40}$ [see Waffler and Hirzel. *Helv. Phys. Acta*, **19**, 216 (1946)]. R. W. P.

539.163 = 4 2913

General prediction of energies and periods for α-disintegration of nuclei. Prediction of α-branching for AcK and Ra^{225}. VIGNERON, L. *C.R. Acad. Sci., Paris*, **225**, 1067–9 (*Dec.* 1, 1947) *In French.*—Values of *E* and log *T* for α-particle emitters are plotted against *Z*. It is shown that smooth curves can be drawn through points representing sets of nuclei with $(N - Z) = \text{const.}$, and that correct estimates can be made with their help for the (now known) periods and energies of various short-lived nuclei. Specific predictions are then made for AcK and Ra^{225}, not yet studied experimentally. A. P. F.

539.163 = 69 2914

Radioactivity of samarium. Use of the photographic plate for the determination of low concentrations of radioactive material. LATTES, C. M. G., SAMUEL, E. G., AND CUER, P. *An. Acad. Brasil Cienc.*, **19** (*No.* 1) 1–28 (1947) *In Portuguese.*—The range of Sm α-particles has been measured in a photographic emulsion and found to be 7·0 μ (1·12 ± 0·03 cm air). An estimate of the ½-life gives $(1·3 \pm 0·1) \times 10^{11}$ years. Both results are in accord with those of previous workers. A further group of α-particles which can be attributed to Po contamination was found. G. P. S. O.

539.163.1 : 519.24 = 4 2915

Determination of the most probable value of statistical parameters. II. The average life of radioactive elements. ALLARD, G. *J. Phys. Radium* (*Sér.* 8) **8**, 262–9 (*Sept.*, 1947) *In French.*—Some applications of the general method developed in the author's previous paper [Abstr. 1385 (1948)]. Several approximation formulae are given. N. L. J.

539.163.2 2916

Coincidence study of gold (198). MANDEVILLE, C. E., AND SCHERB, M. V. Letter in *Phys. Rev.*, **73**, 634–5 (*March* 15, 1948).—γ–γ coincidences from Au^{198} were studied with a resolving time of 0·1 μsec. The coincidence rate was found to be $(0·103 \pm 0·007) \times 10^{-3}$ per γ-ray recorded. The β–γ coincidence rate was $0·19 \times 10^{-3}$ per β-ray recorded, independent of the β-ray energy. No delay was observed between the β-ray and the accompanying 0·4 MeV γ-ray; this makes unlikely the existence of a short-lived metastable Hg^{198}. A. P. F.

539.163.2 2917

Angular distribution of radioactive disintegration products. SPIERS, J. A. Letter in *Nature, Lond.*, **161**, 807–9 (*May* 22, 1948).—The products originate from a partially oriented nuclear spin system at very low temperatures. A theoretical calculation is made of the angular distribution by applying some results in the theory of representations of the group of rotations to the eigenstates of angular momentum. L. S. G.

539.163.2 = 4 291

A contribution to the study of the α rays of actinium VIGNERON, L. *C.R. Acad. Sci., Paris*, **226**, 715–1 (*March* 1, 1948) *In French.*—A study of 800 Ac α-track in the Ilford C_2 emulsion leads to the conclusion that within the limits set by the resolving power of the photo graphic method, the Ac α-ray is simple and has an a range of 3·4 cm (accuracy ~ 2%). The suggestion i made that the 3·1 cm group previously reported [Abstr 175 (1948)] might have been due to a descendant of Ac. R. W. P

539.163.2 : 539.152.1 291

Excited states of B^{10}. LAURITSEN, T., FOWLER, W. A. LAURITSEN, C. C., AND RASMUSSEN, V. K. Letter in *Phys Rev.*, **73**, 636–7 (*March* 15, 1948).—A magnetic-len spectrometer study is reported of Compton- and photo electrons ejected from various radiators by γ-rays from B^{10}. The B^{10} was formed in various states of excitation by using the reactions $Be^9(p,\gamma)$, $Be^9(d,n)$ and $B^{10}(p,p')B^{10*}$. The existence of levels in B^{10} at 0·42, 0·715 and 1·46 MeV above the ground state is inferred. A. P. F

539.163.2 : 539.166 292

On the anomalous absorption of gamma-photons SEN CHAUDHURY, P. K. *Indian J. Phys.*, **22**, 106–1 (*March*, 1948).—The absorption coefficient of RaC γ-rays penetrating through more than 16 cm and up t 20 cm of Pb was measured with a G.M. counter, which was placed at different distances from the source and i vertical and horizontal positions in order to investigat the nature of secondary radiations. The results obtaine show that the heterogeneity of the photon beam and th secondary radiation together have two opposite effect on the apparent absorption coefficient obtained b gradually increasing the thickness of absorber. On predominates over the other depending on the positio of the counter. When the counter is nearer to th absorber surface, the apparent absorption coefficien increases with increasing thickness of Pb, and whe further away, it decreases with increasing thickness These investigations may have some significance in th Rossi transition curve for cosmic rays. When the counte is at a distance 45 cm away from the source, both fo horizontal and vertical positions of the counter, th absorption coefficient of gamma-rays filtered through 19 cm Pb is 416 ± 0·028 cm^{-1}, which is more than 10% less than the theoretical minimum absorption coefficien for γ-rays in Pb. It is concluded that so much differenc may be mainly due to positron annihilation radiation. A

539.164.93 : 778.34 : 771.535.1 = 4 292

Errors caused by latent image fading in studies of charge particles using the photographic method. FARAGGI, H. AND ALBOUY, G. *C.R. Acad. Sci., Paris*, **226**, 717–1 (*March*, 1948) *In French.*—The latent image fading effec in nuclear track plates exposed to α-particles from P has been examined by counting the number of develope grains per track at increasing time intervals betwee exposure and development. Different concentrations o the same developer and development times from 15 t 45 min do not influence the effect. The fading diminishe with increasing sensitivity of the emulsion and can b reduced at low temps and by loading with B. Store emulsions show an increased fading effect. R. H. H

539.165.2 = 3 292

Relations between the half-value periods of radioactive β-emitters. SCHINTLMEISTER, J. *Z. Phys.*, **122** (*Nos* 5–8 527–33 (1944) *In German.*—All β-active nuclei, classified according to the neutron-proton excess, can be made t fit certain smooth curves relating the ½-value period t the atomic number [see Dickson, G. R., and Kono

pinski, E. J. *Phys. Rev.*, **58**, 949 (1945)], on condition that the period may require to be multiplied or divided by one of eight factors. These factors are obtained from the ratios of the periods of isomeric nuclear states. Results are given of a general statistical investigation of the distribution in ½-value periods of β-ray emitters.

R. W. P.

539.166 : 531.719.1 *see Abstr.* 2731

539.166 : 539.163.2 *see Abstr.* 2920

539.166.835 : 537.122 2923

The angular distribution of pair-produced electrons and bremsstrahlung. HOUGH, P. V. C. *Phys. Rev.* **74**, 80–6 (*July* 1, 1948).—The Bethe–Heitler unscreened cross-sections for pair production and bremsstrahlung have been integrated to give the angular distributions. For simplicity, results are restricted to large angles and high energies, but it is shown that extension to smaller angles requires that screening be considered at energies for which screening is important in the usual differential cross-sections. The effect of the finite size of the nucleus is estimated and found to be large at the higher energies. It is shown that large-angle pair production will provide only a very small background for single meson production by quanta. A.

539.167.3 2924

The rate of decay of fission products. WAY, K., AND WIGNER, E. P. *Phys. Rev.*, **73**, 1318-30 (*June* 1, 1948).—By considering the fission products as a sort of statistical assembly, calculations were made of the β-disintegrations per sec and of the total energy emitted per sec at any time after fission has taken place. The results agree well with experiment. Theoretical work is based on the assumption that the mass of a nucleus of mass number A and charge Z is given by $a_0Z[(A) - Z]^2 + b$. Empirical values for a and b are used. Use is also made of an approx. empirical relationship between ½-life and disintegration energy. A further basic hypothesis which is important for the results at very short times after fission has taken place is that, in the most probable way of splitting, the chain lengths of the light and heavy fragments are equal and that there is not much deviation from this most probable mode of fission [Abstr. 2644 (1947)]. The average number of β-disintegrations per fission is found to be 6; the average energy of all radiations (β, γ and neutrino) of the fission products is $21{\cdot}5 \pm 3$ MeV. About half of this energy escapes in the form of neutrinos and a quarter is emitted in the form of β and in the form of γ rays. The possible origin of delayed neutrons is discussed. It is pointed out that the spread of the kinetic energy of a given pair of fission fragments cannot be easily explained on the basis of differences of chain length which result in differences in excitation energy of the fragments. It is possible that fluctuations in the production of fission neutrons are at least partly responsible for the kinetic energy spread. A.

539.167.3 2925

The beta- and gamma-rays of Ga^{72}. MITCHELL, A. C. G., ZAFFARANO, D. J., AND KERN, B. D. *Phys. Rev.*, **73**, 1424–9 (*June* 15, 1948).—The β- and γ-ray spectra of Ga^{72} (14·1 hours) have been measured in a magnetic lens spectrometer. Measurement of the energies of photo-electrons produced in a thin Pb radiator gave lines corresponding to γ-rays of energies 0·631, 0·835, 1·05, 2·18 and 2·50 MeV, and indications of weaker lines at 1·30, 1·47, 1·57 and 1·81 MeV. An internal conversion line, produced by a γ-ray of 0·691 MeV energy, was also found. The β-ray spectrum was found to be highly complex. It is possible to resolve the spectrum into seven groups with end-point energies at 3·17, 2·57, 1·74, 1·45, 1·00, 0·74 and 0·56 MeV. A.

539.167.3 2926

A study of the radiations from iridium (194), iridium (192), lanthanum (140), antimony (124), and zirconium (95). MANDEVILLE, C. E., AND SCHERB, M. V. *Phys. Rev.*, **73**, 1434–41 (*June* 15, 1948).—The β- and γ-radiations of radioactive isotopes, prepared by slow neutron bombardment in the Clinton pile, have been investigated by absorption and coincidence methods. The results are: (1) Ir (194): The β–γ coincidence rate decreases from $0{\cdot}06\times10^{-3}$ coincidence per β-ray at zero absorber thickness to zero at 0·150 g/cm², corresponding to 0·48 MeV, indicating a soft β-ray spectrum of low intensity, and that the hard β-rays of energy 2·2 MeV are non-coincident with γ-radiation. Coincidence absorption experiments revealed the presence of a γ-ray of energy 1·43 MeV. A disintegration scheme is given for Ir^{194}. (2) Ir (192): The β-rays have a maximum energy of 0·56 MeV as measured by absorption in Al and Feather analysis. The β–γ coincidence rate is $0{\cdot}41\times10^{-3}$ coincidence per β-ray, independent of the β-ray energy, suggesting a simple spectrum. On the average, each β-ray is followed by 0·6 MeV of γ-radiation. (3) La (140): The β–γ coincidence rate is $1{\cdot}63\times10^{-3}$ coincidence per β-ray and seems to be independent of the β-ray energy. γ-rays are emitted in cascade and 2·3 MeV of γ-radiation follow each β-ray. (4) Sb (124): Coincidence experiments show a decrease in the β–γ coincidence rate from $0{\cdot}92\times10^{-3}$ coincidence per β-ray at zero absorber thickness to $0{\cdot}38\times10^{-3}$ coincidence per β-ray at 0·110 g/cm². Beyond that point, the coincidence rate remains constant. γ-rays are in cascade and the high energy β-rays are followed by 0·55 MeV of γ-radiation. (5) Zr (95): The 63-day activity was found to emit 0·40 MeV β-rays. The maximum energy of the γ-rays was 0·91 MeV. The β–γ coincidence rate was $0{\cdot}21\times10^{-3}$ coincidence per β-ray, independent of the β-ray energy. The γ–γ coincidence rate, greater than the β–γ coincidence rate, was $(0{\cdot}29 \pm 0{\cdot}02)\times10^{-3}$ coincidence per γ-ray. The 0·91 MeV γ-ray is non-coincident with the β-rays and may be related to some other decay process. A.

539.167.3 2927

Artificially radioactive Se^{73} and Se^{75}. COWART, W. S., POOL, M. L., MCCOWN, D. A., AND WOODWARD, L. L. *Phys. Rev.*, **73**, 1454–7 (*June* 15, 1948).—A radioactive isotope of 7·1 hr ½-life has been produced by α-particle bombardment of germanium. Assignment of the isotope is made to Se^{73}. Absorption measurements indicate the presence of a positron end point of 1·29 MeV. Al X-ray absorption measurements indicate an X-ray emission with a mass absorption coefficient of 22·1 cm²/g, corresponding to 1·17 A. Bombardment with α-particles of Ge^{70}, enriched electromagnetically from 21·2% to 90%, further confirms the assignment of the activity to Se^{73}. The ½-life of Se^{75} is found to be 127 ± 2 days over a decay period of 1 000 days. In this activity K-capture and γ-radiations of 0·22 MeV and 0·43 MeV are observed. A.

539.167.3 2928

Energy quanta emitted in disintegration of ground state of Ba^{133}. YU, F. C., AND KURBATOV, J. D. *Phys. Rev.*, **74**, 34–7 (*July* 1, 1948).—The ground state of radioactive Ba^{133} was correlated with metastable state of Ba^{133*}. It was found that after K-electron capture occurs, there are two excited states in Cs^{133*} corresponding to observed photons of 320 ± 10 and 85 ± 5 keV. Both γ-rays are converted; conversion ratios are $N_e/N_\gamma \simeq 0{\cdot}02$ and $\simeq 0{\cdot}34$, respectively. The change in

angular momenta of the excited states of Cs^{133*} due to emission of 320 keV and 85 keV photons is calculated to be $L = 2$ and $L = 1$. Attempts to observe a third γ-ray of ~ 405 keV did not yield positive results. The calculated intensity of the 405 keV photon, if it is emitted, is estimated as equal to 0·001 of the intensity of the 320-keV photon. A.

539.167.3 2929

Radioactive europium, gadolinium, and terbium. KRISBERG, N. L., POOL, M. L., AND HIBDON, C. T. *Phys. Rev.*, **74**, 44–7 (*July* 1, 1948).—An activity with a ½-life of 18·0 ± 0·2 hr and a weaker one of 5·5 ± 0·2 days have been produced by neutron bombardment of Gd, resulting in a saturation intensity ratio of 25. A deuteron bombardment of Gd gave a ratio of 3 and produced 72-day Tb^{160} with a saturation intensity equal to that of the 5·5 day. The 18·0 hr activity decays by the emission of negative β-particles of 0·85 MeV and a γ-ray of 0·3 MeV. The 5·5 day activity decays by the emission of negative β-particles of 0·5 MeV and γ-rays of 1·28 MeV. Neither the 18·0 hr nor the 5·5 day substance is produced by fast neutron bombardment of Tb, but there is some evidence that both are produced by fast neutron bombardment of Dy. In accordance with the above data both the 18·0 hr and the 5·5 day activities are assigned mass 161. An activity with a minimum ½-life of 20 years and one with a minimum ½-life of 75 days have been produced by a deuteron bombardment of Eu. The decay of the 20 yr activity is by the emission of β-particles of 1·4 MeV and a γ-ray. The 75 day activity is probably attributable to Gd^{153} and the 20 year activity to Eu^{154}. A.

539.167.3 2930

Radioactive isotopes of Ru and Tc. EGGEN, D. T., AND POOL, M. L. *Phys. Rev.*, **74**, 57–62 (*July* 1, 1948).—A new isotope of Ru and one of Tc were found when Mo was bombarded with α-particles. The Ru activity decayed with a ½-life of 1·65 ± 0·05 hr. Positrons, X-rays and γ-rays were emitted with energies of 1·1 MeV, 0·7 A, and 0·95 MeV, respectively. The Ru activity was also produced by fast neutron bombardment of Ru. The Tc activity decayed with a ½-life of 20·0 ± 0·5 hr and emitted X-rays of 0·7 A and γ-rays of 0·78 MeV. The Tc activity was also produced by proton bombardment of Mo. Electromagnetically separated Mo^{92} of 92% abundance was bombarded with α-particles producing the 1·65 hr and 20 hr activities. Electromagnetically separated Mo^{94} of 75% abundance under α-particle bombardment produced a 2·8 day activity. Thus the 1·65 hr, 20 hr and 2·8 day activities can be assigned to Ru^{95}, Tc^{95} and Ru^{97}, respectively. A.

539.167.3 2931

Internal conversion electrons from Sm^{153}-47 hour. HILL, R. D. *Phys. Rev.*, **74**, 78–9 (*July* 1, 1948).—The internal conversion electron spectrum of 47 hr β-radioactive Sm^{153} has been investigated with a β-ray spectrograph. Fourteen lines have been measured in the energy region up to 300 keV, nine of which can be attributed to internal conversions of two γ-rays of 103 and 69·5 keV energy. Other lines are due to Auger electrons from Eu^{153}, and two weak lines are not assigned. A.

539.167.3 = 3 2932

A new 10 minute lanthanum isotope obtained by deuteron bombardment of barium. MAURER, W. *Z. Naturforsch.*, **2a**, 586–7 (*Oct.*, 1947) *In German.*—The isotope was produced by the reaction Ba(d,n) with deuterons $\leqslant 5{\cdot}8$ MeV, and was shown to be a positron emitter, of max. energy 2·1 MeV. A. P. F.

539.17 : 523.112 : 521.042 2933

The origin of chemical elements. ALPHER, R. A., BETHE, H., AND GAMOW, G. Letter in *Phys. Rev.*, **73**, 803–4 (*April* 1, 1948).—A curve for the relative abundance of elements, in general agreement with the observed curve, is obtained on the assumption that it arises primarily from a building-up process from a neutron gas [Abstr. 982 (1947)]. The neutron capture cross-sections used are those given by Hughes [*Phys. Rev.*, **70**, 106 (1946)]. G. J. K.

539.17 : 537.591 = 4 *see Abstr.* 2869

539.17.4 2934

Range of protons from $N^{14}(n,p)C^{14}$. CORNOG, L. C., FRANZEN, W., AND STEPHENS, W. E. *Phys. Rev.*, **74**, 1–4 (*July* 1, 1948).—The mean range of protons emitted in the slow neutron disintegration of N has been measured in a cloud chamber to be 1·00 cm of air, in good agreement with other observers. It is suggested that this range and the energy (561 keV) of the emitted protons as deduced from the $n - H$ mass difference and the extrapolated end point of the C^{14} β-ray spectrum be used to establish a reliable point on the proton range-energy curve. This point lies on Bethe's original 1937 range-energy curve, but disagrees with Bethe's curve revised to fit the ionization chamber range of artificially accelerated protons. A.

539.172 = 3 2935

Excitation functions of some nuclear reactions. RIEZLER, W. Letter in *Naturwiss.*, **34** (*No.* 5) 157 (1947) *In German.*—The processes $C^{12}(d,n)$, $Al^{27}(d,p)$, $Si^{30}(d,p)$ were studied between 0·5 and 6 MeV by passing a deuteron beam of initial energy ~ 6 MeV through a stack of foils, and measuring the individual foil activities produced, due in the respective cases to N^{13} (10 min), Al^{28} (2·3 min) and Si^{31} (2·6 hr). The results are presented graphically. A. P. F.

539.172 ≥ 4 2936

On the stopping power of the interiors of nuclei. CÜER, P., AND MORAND, M. *C.R. Acad. Sci., Paris*, **226**, 659–61 (*Feb.* 23, 1948) *In French.*—The interaction of an incident nucleon with the nucleons forming a nucleus is considered, using a Yukawa potential. If the nucleus is not excited, the incident particle (supposed of a few hundred MeV) cannot lose more than ~ 10 MeV in traversing it. Emission of a few fast nucleons may then occur, but star formation would be expected to be rare. A. P. F.

539.172 : 537.591 = 3 *see Abstr.* 2870

539.172 : 537.591 = 5 2937

Disintegration stars with two centres in photographic emulsions. LOVERA, G. *Ric. Sci. Ricostruz.*, **17**, 2045 (*Dec.*, 1947) *In Italian.*—A "double star" event with a heavy splinter producing the second star is discussed. G. P. S. O.

539.172 : 537.591.8 *see Abstr.* 2879

539.172.1 2938

Theory of the lithium two-alpha-reactions. I. Angular distribution of $Li^7(p,\alpha)\alpha$. INGLIS, D. R. *Phys. Rev.*, **74**, 21–33 (*July* 1, 1948).—The reactions $Li^7(p,\alpha)\alpha$ and $Li^6(d,\alpha)\alpha$ have a special interest because the Bose statistics and consequent even parity of the final pair of α's simplifies the analysis. It is assumed on reasonable grounds that only $p, f \ldots$ protons entering Li^7 are relevant to this reaction, and only entering $s, d \ldots$ deuterons of Li^6. An expression for the energy variation of the angular distribution in the Li^7 reaction is derived from the dispersion formula, with the specific assumption that only two levels of the compound nucleus, having angular momentum 0 and 2, are important in the range of energies employed in the experiments. The angular factor is $1 + A(E)\cos^2\theta + B(E)\cos^4\theta$. The effect of entering

f-waves is also included in the present analysis, and this contribution is not only essential to the existence of $B(E)$ but also makes it possible to obtain agreement with the recent measurements of $A(E)$. Certain matrix elements are treated as arbitrary parameters in obtaining this fit. In addition to the low-energy node apparent in the early data, a second node of $A(E)$ is required at higher energy. The formula derived for $B(E)$ contains the same resonance denominator as does $A(E)$ and is compatible with the present experimental results. The contrasting facts, first, that the easy entrance of s waves makes the $Li^6(d,\alpha)\alpha$ reaction symmetric at very low energies, and second, that the p waves responsible for the Li^7 reaction at low energies may introduce asymmetry, are associated in a simple way with the qualitative experimental observation that both $A(E)$ and $B(E)$ rise more quickly in the Li^7 reaction than in the Li^6 reaction as the bombarding energy is increased from zero. A.

539.172.11 2939

The emission of protons from light nuclei on bombardment wtih α-particles of short range. CHAMPION, F. C., AND ROY, R. R. *Phys. Rev.*, **74**, 5–8 (*July* 1, 1948).—The expansion chamber method was used to obtain tracks of protons ejected in 67 disintegrations of F and 121 disintegrations of Ne under α-particle bombardment. The energetics of the reaction are in good agreement with the mass data, and protons corresponding to transitions to the ground state of the residual nuclei are found with both elements. No disintegrations are detected until the energies of the α-particles reach 3·7 and 4·4 MeV in F and Ne, respectively. These are the only energy levels recorded. The ranges of the protons from F vary within wide limits (an indication of several excited states of the residual nucleus), while those from Ne show only one range corresponding to the ground state. In all cases the angular distribution of the ejected protons is anisotropic, and evidence is given that the low energy α-particles responsible for the disintegrations all make off-centre collisions and therefore possess angular momentum about the nuclear centre. A simple model of the collision process is suggested to account for these results and also for the relative yields, which are in the ratio 1 : 0·5 : 2 for N, F and Ne, respectively. A possible cause of the apparent disintegration of N by α-particles of very low energy is discussed. A.

539.172.13 2940

The $D + D$ cross-section at low energies. FRENCH, A. P. Letter in *Phys. Rev.*, **73**, 1474 (*June* 15, 1948).—Values reported earlier [Abstr. 2576 (1948)] should be reduced by ~10%, in the light of Crenshaw's results [Abstr. 200 (1943)].

539.172.4 2941

Delayed neutrons from U^{235} after short irradiation. DE HOFFMANN, F., FELD, B. T., AND STEIN, P. R. Letter in *Phys. Rev.*, 73, 636 (*March* 15, 1948).—An analysis of the delayed neutron emission into 5 component periods between ~ ½ sec and ~ 80 sec is given. A. P. F.

539.172.4 2942

Cloud chamber investigation of straggling of short-range particles produced by slow neutron reactions. BØGGILD, J. K. Letter in *Nature, Lond.*, **161**, 810–11 (*May* 22, 1948).—The distribution of total ranges of 54 tracks produced by the reaction $N^{14}(n,p)C^{14}$ was determined and it was found that a Gaussian curve fitted the distribution accurately. The distribution of 926 tracks produced by the reaction $B^{10}(n,\alpha)Li^7$ could not be represented by a Gaussian curve. The implications of this are discussed. For relevant experiments see Abstr. 1310 (1947). L. S. G.

539.172.4 2943

Photo-effects in middle-weight nuclei. SCHIFF, L. I. *Phys. Rev.*, **73**, 1311–13 (*June* 1, 1948).—The statistical model is applied to (γ,p) and (γ,n) processes induced by Li γ-rays. It is shown that the assumption of a particular regularity for the residual nuclear states that can arise from the compound nucleus gives results that are in good agreement with recent experiments by Hirzel and Wäffler [Abstr. 188 (1948)]. A.

539.172.4 2944

Fission excitation functions. JUNGERMAN, J., AND WRIGHT, S. C. *Phys. Rev.*, **74**, 150–2 (*July* 15, 1948).—Excitation functions of the reactions U(α, fission), Th (α, fission), U (d, fission), Th (d, fission) were measured by use of α-particles and deuterons of maximum energies of 37·6 and 18·8 MeV, respectively. This was done using a stacked-foil technique. Recoil fission fragments were collected on Al "catchers" and their β-activities formed a relative measure of the number of fissions occurring during a bombardment. An absolute calibration is described. If no competing processes are assumed, comparison with theory results in effective nuclear radii of $11{\cdot}0\times10^{-13}$ cm for the interaction of α-particles with U and $9{\cdot}9\times10^{-13}$ cm for the interaction of deuterons with U. A.

539.18 = 5 2945

On the γ-decay of the meson. VERDE, M. *Ric. Sci. Ricostruz.*, **17**, 2031–7 (*Dec.*, 1947) *In Italian.*—The probability for the transition of a vector meson into a pseudoscalar meson with the emission of a γ-ray is calculated. If the lifetime of the heavier meson $\simeq 10^{-8}$ sec, we must admit that the coupling of one of the meson fields with the nucleons must be fairly weak, to fit experimental facts. L. P.

539.18 : 539.152.1 2946

Capture of negative mesons by nuclei. LODGE, A. S. Letter in *Nature, Lond.*, **161**, 809–10 (*May* 22, 1948).—The period for the nuclear capture of negative mesons from cosmic radiation at low altitudes is discussed. It is supposed that the interaction of heavy mesons with nuclear particles is connected with nuclear forces and that there is no direct coupling between the light mesons and nucleons. Also, positive and negative mesons, differing only in their charge, exist, and these are to be identified with Powell's π- and σ-mesons. Various possible reactions are considered and their ½-lives are calculated. L. S. G.

539.185 2947

Neutron polarization. HUGHES, D. J., WALLACE, J. R., AND HOLTZMAN, R. H. *Phys. Rev.*, **73**, 1277–90 (*June* 1, 1948).—The production of polarized neutrons in magnetized iron was studied, using the intense neutron beams available at the Argonne heavy water pile. The theory [Abstr. 1349 (1942)], used as a guide in the experiments, was checked in many respects, with the exception that the polarization cross-section p has a measured value of 3·15 barns compared to the theoretical 1 barn. The application of neutron polarization to the measurement of the approach to saturation in ferromagnets is described and preliminary results are reported. A.

539.185 2948

Inelastic scattering of fast neutrons by Fe, Pb, and Bi. SZILARD, L., BERNSTEIN, S., FELD, B., AND ASHKIN, J. *Phys. Rev.*, **73**, 1307–10 (*June* 1, 1948).—Measurements of the scattering effects of Ra — α — Be and Ra — α — B neutrons in Fe, Pb and Bi were made. A U^{238} fission threshold detector was used. The method consisted in measuring the fission counting rate in the detector with and without the spherical scatterer surrounding the

source. From the decrease in the counting rate caused by the presence of the scatterer, values of the cross-section for inelastic scattering to below the U^{238} fission threshold were calculated for several assumed values of the elastic scattering cross-section. A.

539.185 : 548.23 *see Abstr.* 2981

539.185.7 = 3 2949

The cross-sections of some elements for thermal neutrons. HOUTERMANS, F. G. *Z. Phys.*, **118** (*Nos* 7–8) 424–5 (1941) *In German.*—Activation cross-sections relative to Mn are given for Cu, Br, Rh, Pd, Ag, In, I, Dy, Ta, W, Au and Bi, using neutrons emerging from a paraffin block. A. P. F.

STRUCTURE OF SOLIDS 539.2

539.213 : 666 = 4 2950

Recent progress in research on the structure of glass. WINTER-KLEIN, A. *Rev. Opt. (Théor. Instrum.)* **27,** 249–57 (*April*, 1948) *In French.*—A short account of the structure and properties of glass, especially on conditions for glass formation. Practical implications are discussed, including the question of forecasting behaviour of new glasses; examples are given. G. O. J.

539.215 : 548.5 *see Abstr.* 2983

539.216.1 : 539.26 2951

On the size of micelles in jute fibre of different qualities and of known strength. CHOWDHURY, S. K., AND SIRKAR, S. C. *Indian J. Phys.*, **22,** 39–42 (*Jan.*, 1948).

539.24 : 531 578 : 539.4.011 *see Abstr.* 2963

539.26 : 539.216.1 *see Abstr.* 2951

539.264 : 548.73 2952

Theory of the structure of clay minerals. Tailed X-ray reflexions from random layer lattices. WILSON, A. J. C. *Nature, Lond.*, **161,** 773–4 (*May* 15, 1948).—Expressions are derived for the line profile of certain reflections. This does not involve Warren's approximation [Abstr. 1399 (1941)], in which the true intensity variation was replaced by a Gaussian distribution. L. S. G.

539.264 : 548.73 2953

Banded X-ray reflexions from clay minerals. BRINDLEY, G. W., AND MÉRING, J. *Nature, Lond.*, **161,** 774–5 (*May* 15, 1948).—An expression for the intensity distribution of the reflections is obtained. This is more general than Warren's formula [Abstr. 1399 (1941)], and involves a numerical integration. L. S. G.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.319 : 666.115 2954

Stresses in glass and their measurement. PADMOS, A. A., AND DE VRIES, J. *Philips Tech. Rev.*, **9** (*No.* 9) 277–84 (1947–48).—Gives an account of formation of stresses in glass articles and of methods of measuring them. Describes method used by Philips for pretesting suitability of glasses or metals to be fused together, in which samples are fused to a standard glass and the combination tested for double refraction. G. O. J.

539.32 : 535.551 : 548.0 *see Abstr.* 2980

539.37 = 4 2955

On the lines of slip and the calculation of displacements in plastic deformation. MANDEL, J. *C.R. Acad. Sci., Paris,* **225,** 1272–3 (*Dec.* 22, 1947) *In French.*—Continuing earlier work on plastic flow [*C.R. Acad. Sci., Paris,* **222,** 1205–7 (1946)] the author derives the equations for determining the displacements, for plain strain, in the case of an arbitrary intrinsic curve whose tangent makes a variable angle ϕ, with the axis of the normal strains. G. O. B.

539.373 295

Slip at grain boundaries and grain growth in metals MOTT, N. F. *Proc. Phys. Soc., Lond.*, **60,** 391–4 (*April* 1948).—An attempt to explain theoretically the observed behaviour of Al, on the hypothesis that the elementary occurrence allowing grain boundary slip or grain growth to take place is the disordering or melting of a small group of the order of 10 to 100 atoms. L. G. C

539.373 = 3 295

On glide of metal structures of the magnesium group SEIFERT, H. Letter in *Naturwiss.*, **34** (*No.* 3) 89 (1947) *In German.*—It is suggested that glide does not occur in the directions given by rows between whose atoms Fourier synthesis shows high electron densities. A. J. C. W

539.374 295

Elasto-viscous effect in shellac. BASU, S. *Indian J. Phys.*, **22,** 55–63 (*Feb.*, 1948).—Elasto-viscous properties of T. N. shellac and partially polymerized samples were measured. The total extension is due to 3 distinct processes: (1) true elastic deformation, (2) delayed elastic deformation and (3) a viscous flow. These processes are explained by attributing an iso-colloidal structure to shellac. Calculation of the relaxation time shows that the dispersed phase consists of micelles, whose formation is due to secondary forces between the molecules. The dispersion medium consists of monomeric particles. On partial polymerization, the polymeric products form a part of the dispersion medium, increasing its viscosity. The low value of extension is explained by the granular nature of the micelle. A.

539.374 : 551.311.123 *see Abstr.* 3029

539.389.3 : 532.12 = 4 295

Elastic recovery and relaxation of concentrated solutions of macromolecular substances. CONSEILLER, Y. *C.R. Acad. Sci., Paris,* **225,** 1007–9 (*Nov.* 24, 1947) *In French.*—Concentrated solutions of macromolecular substances, which are true liquids, also possess some of the characteristics of plastic solids. They show elastic recovery, e.g. when an applied force is suddenly removed, and the relaxation of the internal elastic stress can be followed directly. Two constants can be defined and measured: (*a*) time of relaxation; (*b*) time of elastic recovery; these are different in general, (*a*) usually < (*b*), the latter varying from 1 to 10^3 sec, depending on the nature of the system, the concentration and the age of the solutions. Results are given of measurements on solutions of nitrocellulose. J. I.

539.389.3 : 666 296

Annealing of glass. JONES, G. O.; COX, S. M. Letters in *Nature, Lond.*, **161,** 813 (*May* 22, 1948).—Correspondence arising out of earlier communications [Abstr. 2218–19 (1948)].

539.4.011 : 531.578 296

The use of flat-ended projectiles for determining dynamic yield stress. I. Theoretical considerations. TAYLOR, G. *Proc. Roy. Soc. A,* **194** (*No.* 1038) 289–99 (1948).—It has long been known that metals may be subjected momentarily to stresses far exceeding their static yield stress without suffering plastic strain. One of the simplest methods for subjecting a metal to a high stress for a short time is to form it into a cylindrical specimen and fire this at a steel target. The front part of this projectile crumples up, but the rear part is left undeformed. If the target is rigid the distance which this portion travels while it is being brought to rest may be taken as the difference between the initial length and the length of the deformed specimen after impact. Knowing the velocity of impact, a minimum possible value can be assigned to the maximum acceleration of the material,

and from this a minimum value for the yield stress can be calculated. The actual yield stress is considerably greater than this minimum, and methods are given for calculating a more probable value. A.

539.4.011 : 531.578 2962

The use of flat-ended projectiles for determining dynamic yield stress. II. Tests on various metallic materials. WHIFFIN, A. C. *Proc. Roy. Soc. A*, **194** (*No.* 1038) 300–22 (1948).—A description is given of the experimental technique devised to apply the method outlined theoretically in Part I to the measurement of the dynamic compressive yield strength of various steels, duralumin, Cu, Pb, Fe and Ag. Details are given of the accuracy of the various measurements, and of their effect on the values of yield strength. The method was found to be inaccurate at low and high velocities. For instance, with mild steel, satisfactory results were only obtainable within the range 400 to 2 500 ft/sec. The range of velocities within which satisfactory results could be obtained varied with the quality of the material tested, soft metals giving results within a much lower range than that necessary for harder materials. Because of its failure at low velocities, the method could not be employed to bridge the gap between static and dynamic tests. The rate of strain employed in the dynamic tests could not be measured, but was estimated to be $\sim$ 10 000 in/in/sec. In general, the dynamic compressive yield strength $S >$ the static strength Y represented by the compressive stress giving 0·2% permanent strain. For steels of various types, regardless of chemical composition and heat treatment, there was a relation between S/Y and the static strength Y, the ratio decreasing from $\sim$ 3 when Y was 20 tons/in² to 1 when Y was 120 tons/in². A similar relation occurred with duralumin, S/Y varying from 2·5 at $Y = 8$ to 1·4 at $Y = 25$ tons/in². A.

539.4.011 : 531.578 : 539.24 2963

The use of flat-ended projectiles for determining dynamic yield stress. III. Changes in microstructure caused by deformation under impact at high-striking velocities. CARRINGTON, W. E., AND GAYLER, M. L. V. *Proc. Roy. Soc. A*, **194** (*No.* 1038) 324–31 (1948).—The mechanism of deformation of metals at high velocities has been studied by examining the microstructure of cylinders of mild steel, duralumin and standard silver (of composition Ag 92·5%, Cu 7·5%) of similar hardness, and of steel balls after impact on steel plates at velocities from 300 to 3 830 ft/sec. The means by which the stress on impact was relieved depended on the material, and was first the formation of twins or "compression bands," i.e. by block movement of wedges of material within individual grains, or by cracking. When the applied stress could no longer be relieved in this way, plastic deformation occurred. The amount of residual strain in deformed mild steel and duralumin has been examined by observing changes of microstructure after annealing. Hardness surveys were made on longitudinal sections of the cylinders and the results correlated with the microstructures and with observations of the limits of strain due to impact. A.

539.4.015 : 532.782 2964

Internal friction in the interstitial solid solutions of C and O in tantalum. KÊ, T'-S. *Phys. Rev.*, **74**, 9–15 (*July* 1, 1948).—A strongly temperature-dependent type of internal friction is observed in Ta specimens containing a small amount of C or O. Internal friction peaks occur, respectively, around 150°C and 170°C for C and O when the frequency of vibration $\simeq$ 1 c/s. The activation energies associated with these relaxations are found to be 25 000 cal./mole for C and 29 000 cal./mole for O. These observations are consistent with the viewpoint that the relaxations observed are associated with the anelasticity caused by the stress-induced preferential distribution of C or O among the various interstitial positions which have tetragonal symmetry in body-centred cubic Ta. Such a picture has been proposed by Snoek in interpreting the relaxation phenomena observed in α-Fe (body-centred cubic) containing small amounts of C or N. The observations in Ta might thus indicate that such relaxations are characteristic of all interstitial solid solutions of body-centred cubic metals. It has been further found that the C relaxation peak can be interpreted in terms of a relaxation process having a single relaxation time with a unique activation energy while the O peak cannot. This suggests that the interstitial atoms responsible for the observed relaxation peaks in Ta are situated at the octahedral positions in the case of C and at both octahedral and tetrahedral positions in the case of O. A.

539.4.015 2965

Stress relaxation by interstitial atomic diffusion in tantalum. KÊ, T'-S. *Phys. Rev.*, **74**, 16–20 (*July* 1, 1948).—In a preceding article [Abstr. 2964 (1948)] it was shown that the internal friction peaks observed in Ta containing small amounts of C and O are caused by the stress-induced preferential distributions of C or O among the interstices in Ta. In order to elucidate this viewpoint further, the relaxation strength associated with these relaxations has been determined by rigidity and stress relaxation measurements in torsion covering a wide range of temperature. When (relaxation strength)$^{-1}$ is plotted against absolute temperature, the graph is a straight line passing through the origin. This linear relationship agrees with that predicted by theory assuming a model of stress-induced preferential distribution. The finding that the extrapolated line passes through absolute zero temperature shows that the interaction between solute atoms is negligibly small. This implies that the critical temperature for self-induced preferential distribution of solute atoms is close to absolute zero. A.

539.434 = 4 2966

Creep. ANDRADE, E. N. DA C. *J. Phys. Radium* (*Sér.* 8) **8**, 313–26 (*Nov.*, 1947) *In French.*—In this lecture to the French Physical Society, the author first reviews the phenomenon of creep from the physicists' and engineers' viewpoints and proceeds to discuss the interpretation in terms of the behaviour of single crystals. The preparation and properties of single crystals are described, and the dislocation theories of Taylor, Becker and Orowan are reviewed. N. F. A.

539 501 2967

Rectilinear plastic flow of a Bingham solid. III. A more general discussion of steady flow. OLDROYD, J. G. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 3) 200–13 (1948).—All possible velocity distributions are obtained by solving a single linear 2nd-order differential equation, and some special classes of velocity distributions are discussed. In the present method the equations are first solved, and then suitable boundaries are found. This is illustrated by an example. The family of curves representing velocity contours are also possible velocity contours for rectilinear viscous flow. The velocity distributions represent exact solutions of the equations of motion. See Abstr. 199 (1948) for earlier work. L. S. G.

539.501 2968

Rectilinear plastic flow of a Bingham solid. IV. Non-steady motion. OLDROYD, J. G. *Proc. Camb. Phil. Soc.*, **44** (*Pt* 3) 214–28 (1948).—The equation of motion

in a region of plastic flow is the same as the equation for heat conduction in a medium of variable conductivity, in which heat is being generated. In this analogy, a yield surface corresponds to a conducting boundary moving through the medium in such a way that no heat is conducted to it. For a 2-dimensional rectilinear motion, exact solutions of the equations were found. These correspond to a uniform gradient and uniformly accelerated plane boundary. The velocity distribution was calculated in the case of a plastic solid in a circular pipe being suddenly subjected to a pressure gradient.

L. S. G.

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM 541.121/.123

541.123.3 : 669.018 *see Abstr.* 3056

541.123.5 : 548.7 *see Abstr.* 3000

REACTION KINETICS 541.124/.128

541.128.5 : 541.183 : 538.214 *see Abstr.* 2881

ELECTROCHEMISTRY 541.13

541.13 = 3 2969

Waves of activation on passive iron wires. BONHOEFFER, K. F., AND RENNEBERG, W. *Z. Phys.*, **118** (*Nos* 7–8) 389–400 (1941) *In German.*—Measurements of the propagation velocity of an activated zone on the "passive" surface of a long Fe wire immersed in a glass tube containing nitric acid were made with an oscillograph. The activation was initiated by a short duration electric current. The effect of tube diameter and acid concentration on the velocity was examined. The physical interpretation of this phenomenon, discovered by Ostwald, is discussed. T. S. E. T.

541.132 2970

The aqueous ionization constants of inorganic oxygen acids. RICCI, J. E. *J. Amer. Chem. Soc.*, **70**, 109–13 (*Jan.*, 1948).—Theoretical calculations have been critically examined, and their inadequacy in testing the fundamental assumption of a proton transfer from solute to solvent has been pointed out. An empirical correlation and grouping of these ionization constants based on the formal charge of the central atom and the number of non-hydroxyl O atoms in the acid is advanced which, since it is apparently independent of the "structure" of the acid, may indicate the need for a different picture of the ionization process. W. R. A.

541.135.5 2971

The glass electrode. JACKSON, J. *Chem. and Ind.*, 7–10 (*Jan.* 3, 1948).—The general expression for the e.m.f. of any cell comprising an electrode responding ideally to p_H and a reference electrode and set down as a function both of p_H and temperature, is simplified on the assumption that t^2 is in general not large, justification for which is given. The use of the isopotential point concept, which facilitates the accurate calculation of p_H values from e.m.f. readings in which temperature is a (known) variable, is discussed, and tables of such points are given for several elementary cells and for some glass electrode cells. Practical considerations in making the choice of the reference electrode are reviewed, the thermal lag in the glass electrode discussed and the errors due to temperature effects indicated. Seven references are included. H. H. HO.

PHOTOCHEMISTRY 541.14

541.141.12 : 771.534.2 *see Abstr.* 3059

ADSORPTION 541.183

541.183 = 3 2972

Films and mixed films of long-chain dibasic esters. TRURNIT, H. J. *Z. Naturforsch.*, **2a**, 258–66 (*July–Aug.*, 1947) *In German.*—The force-area curves of certain long-chain dibasic esters E, e.g. $(CH_2)_{16}(COOC_4H_9)_2$ have been determined, both alone and in admixture with each other and with stearic acid. The curves for pure E at high areas somewhat resemble those of the liquid-expanded, or perhaps vapour-expanded, state; they then pass, though without a sharp kink-point, into the liquid-intermediate state where the Langmuir micellar theory is found to apply. A flexible molecule E_f (COO in middle of chain) tends to become vertically oriented if admixed with a rigid molecules E_r (COO at end); $E_f + E_r$ can therefore be compressed to much smaller areas before collapse than can E_f alone. The ratio of $E_r : E_f$ required for such stabilization depends on the ratio of the two chain lengths, the position of the COO group and the temperature. S. J. G.

541.183 : 532.6.08 = 3 *see Abstr.* 2739

541.183 : 541.128.5 : 538.214 *see Abstr.* 2881

ATOMIC THEORY 541.2

541.23 : 539.155.2 = 3 *see Abstr.* 2909

541.265 : 541.67 = 4 *see Abstr.* 2974

CHEMICAL STRUCTURE 541.4/.6

541.57 : 539.132 = 4 *see Abstr.* 2898

541.65 : 535.343 2973

The correlation of vibrational absorption spectra with molecular structure. THOMPSON, H. W. *J. Chem. Soc.*, 328–31 (*March*, 1948).—Rules are given relating spectra to characteristic groupings. A.

541.67 : 541.265 = 4 2974

Study of the magnetic susceptibilities and parachors of certain lead alkyls. Comparison with tin alkyls. KADOMTZEFF, I. *C.R. Acad. Sci., Paris*, **226**, 661–3 (*Feb.* 23, 1948) *In French.*—Magnetic susceptibilities (χ) and parachors (P) of $PbMe_4$, $PbEt_4$, $PbPr_4$, $PbBu_4$ and $Pb(C_7H_{15})_4$ have been measured and values for Pb have been derived. Values of χ and P for Pb vary with alkyl chain length in an analogous manner. The data are compared with refractivity data. Sn alkyls behave similarly. A new value for the atomic parachor of Pb is proposed. W. R. A.

541.67 : 548.33 = 4 2975

Magnetochemistry and polymorphism. PACAULT, A., AND GUY, J. *C.R. Acad. Sci., Paris*, **226**, 723–4 (*March* 1, 1948) *In French.*—Three forms of *cis-* and two of *trans*-cinnamic acid were measured. *α-trans*, *cis-* (m.p. 68°), and *cis-* (m.p. 58°) cannot be distinguished by this method. Comparison of experimental values with those computed on the basis of Pascal's systematics shows that the experimental values of all the cinnamic acids (except the *cis*-isomeride of m.p. 42°—which could not be measured with the same accuracy) are $\sim 9\% <$ the computed values. This anomaly is not encountered with styrolene, benzalmalonic acid, phenylpropiolic acid,

or chalcone and, consequently, cannot be attributed to the mode of linking of the side chain to the aromatic nucleus. W. R. A.

541.68 : 534.321.9 = 4 *see Abstr.* 2753

541.9 2976

The periodic system of the chemical elements in three dimensions. (The "five-five system.") OPPEGAARD, A. G. *J. Chem. Soc.*, 318–21 (*March*, 1948).—A new classification of the chemical elements is presented. It is based on an arrangement of the elements in three dimensions, and has the following advantages: (1) Elements of related chemical properties but with different typical valency are collected into "planes." (2) Elements with same typical valency are collected into "groups." (3) Several weaknesses of the present forms of the periodic system are overcome. (4) It has a bearing on the geochemical distribution of elements. A.

CHEMICAL APPARATUS 542.1/.7

542.23 2977

An automatic constant level controller for low boiling-point liquids. JONES, G. O. *J. Sci. Instrum. Phys. Ind.*, **25**, 239–42 (*July*, 1948).—The controller will keep constant the level of low boiling-point liquid in a container by regulating the entry of fresh liquid from a main reservoir. This regulation is performed by a strong valve actuated by a vapour-pressure thermometer and elastic bellows. There are no external connections or relay system. With appropriate adjustments and procedure the instrument can be used for any low boiling-point liquid. The action is fully automatic. A.

542.48 : 539.155.2 *see Abstr.* 2910–11

CHEMICAL ANALYSIS 543/545

545.822 2978

The effect of variations in the general composition of samples in spectrographic analysis. LANGSTROTH, G. O., AND ANDRYCHUK, D. *Canad. J. Res., A*, **26**, 39–49 (*March*, 1948).—Variations that occur in intensity ratios belonging to pairs of elements on the addition of various extraneous substances to standard samples were studied using a common type of condensed spark discharge. The extent of the variations depended on the test elements chosen, the nature of the added substance, the line pair investigated, and on whether or not the standard samples were buffered. The variations bore no apparent relation to the relative ionization potentials or atomic weights of the test elements, nor to any physical property of the added substances. In general, they were smaller for the line pairs having the most nearly equal excitation potentials. Usually they were smaller for buffered than for unbuffered samples. Illumination of the electrodes with u.v. light, though resulting in steadier operation of the discharge, or alterations of the capacity in the sparking circuit did not reduce the variations materially. But operation of the discharge at constant current coupled with the use of a buffer did reduce the variations considerably for the instances studied. A.

545.822 : 537.523.4 *see Abstr.* 2851

CRYSTALLOGRAPHY 548

548.0 : 535.81 = 3 *see Abstr.* 2809

548.0 : 537.226 *see Abstr.* 2832

548.0 : 537.228.1 = 3 *see Abstr.* 2834

548.0 : 537.228.1 : 537.531 2979

Effect of the piezoelectric properties of a crystal on diffuse X-ray reflections. MILLER, D. C. *Phys. Rev.*, **74**, 166–9 (*July* 15, 1948).—A study of the diffuse X-ray reflections from piezoelectrically oscillating quartz and ammonium dihydrogen phosphate (ADP) crystals showed no increase in intensity during oscillation. Quantitative measurements of the intensity increase of the Laue and Bragg reflections during oscillation showed an increase of ~ 160% for the quartz, 7·7% for a 0·015 in thick ADP crystal and 4% for a rochelle salt crystal. The intensity increase of Laue reflections for the ADP crystal was shown to be dependent upon its orientation. Since there was no decrease in intensity of the diffuse reflections, it eliminates the possibility that they are the source of the increased energy in the Laue and Bragg reflections. A.

548.0 : 539.32 : 535.551 2980

Mechanical properties of NaCl, KBr, KCl. GALT, J. K. *Phys. Rev.*, **73**, 1460–2 (*June* 15, 1948).—The pulse method has been applied to measure mechanical properties of NaCl, KBr, and KCl at 10 and 30 Mc/sec. The elastic constants of KBr have been measured in the low temperature region. The strain-optical constants have been measured by a travelling-wave method suggested by Mueller [Abstr. 2960 (1939)]. A.

548.23 : 539.185 2981

Crystal orientation in Al by slow neutron diffraction. ARNOLD, G., AND WEBER, A. H. *Phys. Rev.*, **73**, 1385–9 (*June* 1, 1948).—Investigations are described of crystal orientation effects in various forms of Al by measurement of total cross-sections in the neutron energy range 0·003 to 0·05 eV approx. A.

548.3 2982

The existence of β-cristobalite at room temperature. GRENALL, A. *J. Amer. Chem. Soc.*, **70**, 423–4 (*Jan.*, 1948).—Overheating of pelleted clay catalyst showed that some pellets were fused and glassy in external appearance but the centres were not glassy. X-ray examinations of surface and centre material revealed the presence of β-cristobalite in the surface material and α-cristobalite in the centre material. W. R. A.

548.32 : 548.73 *see Abstr.* 3008

548.33 : 541.67 = 4 *see Abstr.* 2975

548.5 : 539.215 2983

Instantaneous rates of grain growth. BECK, P. A., HOLZWORTH, M. L., AND HSUN HU. *Phys. Rev.*, **73**, 526–7 (*March* 1, 1948).—[See Abstr. 1971 (1947)]. The rate of increase is related to the actual value of the average grain size D of Al sheet according to the equation $\log (dD/dt) = \log n + n^{-1} \log K + (1 - 1/n) \log D$ where n and K are functions of the temperature only. The "heat of activation" Q for grain growth increases from $3{\cdot}8 \times 10^4$ to $6{\cdot}0 \times 10^4$ cal./gram-atom as D increases from 0·015 to 0·05 cm. For 70–30 brass, Q has the constant value $6{\cdot}18 \times 10^4$. A. J. C. W.

548.5 : 549.514.51 2984

The laboratory growing of quartz. HALE, D. R. *Science*, **107**, 393–4 (*April* 16, 1948).—A brief review of past experiments, and work in progress (11 references).

548.5 : 777.9 *see Abstr.* 2641

548.538 : 549.623.5 : 535.347 = 69 2985

Investigation on anisotropy of crystal surfaces. Results obtained with muscovite. ZOCHER, H. *An. Acad. Brasil Cienc.*, **19** (*No.* 1) 43–50 (1947) *In Portuguese.*—Con-

centrated solutions of certain dyes (methylene blue, neutral red) dry on crystal surfaces to form dichroic films. On muscovite the film normally shows maximum absorption when the electric vector is at either + 30° or − 30° to the plane of symmetry. Areas of uniform behaviour, probably corresponding to cleavage along a single lattice plane, of up to 10 cm² are observed. Occasionally small areas show maximum absorption with the electric vector perpendicular to the plane of symmetry. The effect of heat, acids and alkalis on the state of the surface is described. Dichroic films are also produced on biotite and phlogopite. A. J. C. W.

548.7 2986

The eigenvibrations of crystal structures. RAMAN, C. V. *Curr. Sci.*, **17**, 1–11 (*Jan.*, 1948).—A review of "Symposium of papers on the vibration spectra of crystals" [Abstr. 2989, etc. (1948)].

548.7 2987

Crystal radii of the heavy elements. ZACHARIASEN, W. H. *Phys. Rev.*, **73**, 1104–5 (*May* 1, 1948).—Crystal radii for the trivalent and tetravalent ions of the heavy elements from Ac to Am as deduced from crystal structure data are listed and briefly discussed. A.

548.7 : 531.19 2988

General theory of the quasi-chemical method in the statistical theory of superlattices. YANG, C. N., AND LI, Y. Y. *Chin. J. Phys.*, **7**, 59–71 (*Dec.*, 1947).—The generalization of the quasi-chemical method of Fowler and Guggenheim [Abstr. 2575 (1945)] is extended to a binary alloy of any composition. The formulae are very similar to those for the composition 1 : 1. The alloy $AuCu_3$ is treated in detail. A.

548.7 : 534.1 2989

The vibration spectra of crystals. I. Basic theory. RAMAN, C. V. *Proc. Indian Acad. Sci. A*, **26**, 339–55 (*Dec.*, 1947).—The author's theory of the vibration spectra of crystals is presented from a new viewpoint. It is shown that the nature of the spectra differs necessarily in the two regions in which they represent the characteristic eigenvibrations of the crystal structure and the stationary wave-patterns of elastic vibration. Eigenvibrations repeat themselves in volume elements within the crystal and have twice the linear dimensions and 8× the volume of the lattice cells. When the number of atoms in the lattice cell is p there will be $24p - 3$ modes of eigenvibration and $24p - 3$ (sometimes less on account of crystal symmetry) monochromatic frequencies, highly degenerate in relation to the whole crystal. The three missing degrees of freedom are exactly accounted for when possible elastic vibrations, which give a quasi-continuous spectrum of frequencies, are enumerated. Limiting elastic wavelengths are 4× the lattice spacings of the crystal. Anharmonicity causes a lowering and spreading out of the spectral frequencies at higher temp. W. R. A.

548.7 : 534.1 2990

The vibration spectra of crystals. II. The case of diamond. RAMAN, C. V. *Proc. Indian Acad. Sci. A*, **26**, 356–69 (*Dec.*, 1947).—From consideration of the crystal structure of diamond its 9 eigenvibrations are arranged in descending frequency. The magnitude of the force constants can be defined, and derived numerical values of frequencies agree well with observed values. The geometry of the modes determines the changes in bond polarizabilities and electron distributions produced by them, from which their activities in light-scattering and in infra-red absorption can be ascertained in close agreement with experimental data. The observed intensity of the 2nd-order effects, relative to those of the 1st-order, indicates that the eigenvibrations are localized in volume elements of a size comparable to that of the lattice cells of the crystal. W. R. A.

548.7 : 534.1 2991

The vibration spectra of crystals. III. Rocksalt. RAMAN, C. V. *Proc. Indian Acad. Sci. A*, **26**, 370–82 (*Dec.*, 1947).—Vibration frequencies of the rocksalt structure are determined entirely by short-range atomic interactions because the effects of Coulomb forces cancel out. Values of the 9 eigenfrequencies calculated on this basis agree with observed values. In discussing their activities in light-scattering and infra-red absorption it is shown that the most strongly active vibration in light-scattering is that of the Cl' ions normal to the octahedral planes, the $Na^{\cdot}$ ions being at rest. The infra-red absorption peak at 61μ does not represent the frequency of oscillation of Na and Cl lattices with respect to each other but is shifted with respect to it owing to the activity of other modes in that region. W. R. A.

548.7 : 534.1 2992

The vibration spectra of crystals. IV. Magnesium oxide. RAMAN, C. V. *Proc. Indian Acad. Sci. A*, **26**, 383–90 (*Dec.*, 1947).—Theoretically, the 9 fundamental frequencies of the MgO structure should occur at 14·2, 14·7, 15·35, 17·1, 19·0, 21·1, 23·4, 38·8, and 54·4 μ. The experimental values for the first 7 are in close agreement and their over- and combination-tones are also in satisfactory agreement. W. R. A.

548.7 : 534.1 2993

The vibration spectra of crystals. V. Lithium and sodium fluorides. RAMAN, C. V. *Proc. Indian Acad. Sci. A*, **26**, 391–5 (*Dec.*, 1947).—Derived theoretical values for the eigenfrequencies of LiF and NaF agree with experimental data. The disparity in the atomic weights of metal and F produces differences in behaviour of the two salts. In both, however, the frequency of maximum absorption does not correspond with the oscillation of the metal and F atoms against each other, but agrees with the F atom moving and the metal atom remaining at rest. W. R. A.

548.7 : 534.1 2994

The vibration spectra of crystals. VI. Sylvine. RAMAN, C. V. *Proc. Indian Acad. Sci. A*, **26**, 396–8 (*Dec.*, 1947).—The 9 eigenfrequencies of sylvine have been evaluated. The wavelength at which the maximum absorption is shown by very thin films is discussed, as are absorption and reflection data over the whole wavelength range. The force constants are slightly < those of rocksalt. W. R. A.

548.7 : 534.1 2995

Dynamical theory of the vibration spectra of crystals. I. Diamond. RAMANATHAN, K. G. *Proc. Indian Acad. Sci. A*, **26**, 481–92 (*Dec.*, 1947).—Exact expressions have been derived for the frequencies of the 9 normal modes of vibration of the diamond structure. Account is taken of the forces of interaction between each atom and its 28 nearest neighbours, and the formulae involve 8 independent constants and an additional relation between them. The constants are perfectly determinate if the frequencies are known. Interactions decrease very rapidly as distance increases. W. R. A.

548.7 : 534.1 2996

Dynamical theory of the vibration spectra of crystals. II. The rocksalt structure. RAMANATHAN, K. G. *Proc. Indian Acad. Sci. A*, **26**, 493–9 (*Dec.*, 1947).—Exact expressions for the frequencies of the 9 eigenvibrations of rocksalt are derived in terms of 11 independent constants which take account of the influence of the 26 nearest

neighbours of each atom. The constants are connected by two relations. W. R. A.

548.7 : 534.1 2997

Dynamical theory of the vibration spectra of crystals. III. The caesium chloride structure. RAMANATHAN, K. G. *Proc. Indian Acad. Sci. A*, **26**, 500–6 (*Dec.*, 1947).—Exact expressions for the 11 eigenfunctions of the CsCl structure are derived in terms of 12 constants, which take account of the influence of the 26 nearest neighbours of each atom, the constants being connected by two relations. Simplified formulae for the frequencies are also given in terms of 4 independent constants which are connected by an additional relation. W. R. A.

548.7 : 534.1 2998

Dynamical theory of the vibration spectra of crystals. IV. The metallic crystals. RAMANATHAN, K. G. *Proc. Indian Acad. Sci. A*, **26**, 507–10 (*Dec.*, 1947).—Exact expressions are derived for the frequencies of the eigenfunctions of the face-centred and body-centred cubic lattices in terms of 6 and 5 force constants respectively. W. R. A.

548.7 : 535.375.5 *see Abstr.* 2790–3

548.7 : 535.376 *see Abstr.* 2795

548.7 : 535.43 : 535.375.5 *see Abstr.* 2794

548.7 : 537.531 : 535.43 : 534.614 *see Abstr.* 2755

548.7 : 538.222 2999

Changes in the orientations of the principal magnetic axes of single crystals of the iron group of salts with variation of temperature. BOSE, A. *Indian J. Phys.*, **22**, 74–9 (*Feb.*, 1948).—In most of the crystals studied the orientations were found to change very little with temperature. In a few cases the changes were large and are to be attributed to changes in the relative orientations of the different paramagnetic groups present in the unit cell of the crystal, since the binding between such groups is comparatively weak. The individual members of the paramagnetic groups are bound much more firmly so that these groups persist even in the state of solution and in consequence the electric field axes associated with each group do not change. A.

548.7 : 541.123.5 3000

Electrical charges in layer-lattice silicates in relation to ionic exchange. MITRA, R. P., AND RAJAGOPALAN, K. S. *Indian J. Phys.*, **22**, 129–40 (*March*, 1948).—Many layer-lattice silicates, e.g. the micas and the clay minerals, show, especially in finely divided states, a marked capacity to exchange some of the exposed ions of the silicate lattice for similarly charged ions of a "contact" solution. The mechanism of this ionic exchange and the nature and the origin of the (surface) charges which hold the exchangeable ions in the liquid phase at some distance from the surfaces of the crystallites is discussed. The most polar ions on the surface of the crystallites interact with the dipoles of the "contact" liquid which makes them execute a certain type of oscillatory motion about mean positions in the liquid phase at some distance from the surface, and it is these ions which, under suitable conditions, are exchanged for similarly charged ions present in the liquid phase. The mechanism of this ion-dipole interaction and its electrochemical consequences, especially, in regard to the exchange behaviour of the crystallites are discussed, taking the mica-water system as a model. The nature of the so-called "broken bonds" developed on the lateral surfaces of the crystals and the role frequently attributed to them in determining the ion-exchange properties of these systems is also discussed. The acidic and basic character of hydroxyl groups present in these silicates is examined. A.

548.73 3001

Intensity measurements on Zn–Fe-spinel and its solid solutions with Fe_2O_3. BERGER, S. V. *Trans. Chalmers Univ. Tech. Gothenburg* (*No.* 66) 14 *pp.* (1948).—$Zn_8Fe_{16}O_{32}$ and $Zn_{3.2}Fe_{19.2}O_{32}$ have the normal spinel structure with $u \simeq 0{\cdot}387$. The second contains vacant sites. A. J. C. W.

548.73 = 4 3002

Use of a double monochromator for the study of X-ray scattering at very low angles. GUINIER, A., AND FOURNET, G. *C.R. Acad. Sci., Paris*, **226**, 656–9 (*Feb.* 23, 1948) *In French.*—A slit is placed at the focus of the first curved-crystal monochromator, and the rays are focused on the film by the second monochromator. Background is greatly reduced, at the expense of a 4- to 12-fold increase in exposure time. Spacings up to 250 Å can be investigated, and it may be possible to reach 600 Å. A. J. C. W.

548.73 3003

Dynamic X-ray reflections in crystals. RAMAN, C. V. *Curr. Sci.*, **17**, 65–75 (*March*, 1948).—A short general account of the author's theories published in papers in *Proc. Indian Acad. Sci.* (7 photographs, 3 figures).

548.73 3004

Crystalline texture and the determination of structure amplitudes. WOOSTER, W. A., AND MACDONALD, G. L. *Acta Cryst.*, **1**, 49–54 (*May*, 1948).—Absolute measurements of the integrated reflection for selected planes in calcite, quartz, gypsum, fluorspar and mica have been made using both Mo and Cu characteristic radiations. An experimental method is described whereby the structure amplitude can be determined in spite of the great variations in the integrated reflection associated with the different degrees of imperfection found in crystals of the same species. It is shown that it is necessary to use more than one wavelength of X-rays in assessing the degree of imperfection of a given specimen from the value of the integrated reflection. A.

548.73 3005

The use of the double crystal spectrometer in the analysis of Bragg reflections at very small angles. KAESBERG, P., RITLAND, H. N., AND BEEMAN, W. W. *Phys. Rev.*, **74**, 71–3 (*July* 1, 1948).—A two-crystal spectrometer has been used to investigate X-rays scattered from the large periodicities in wet collagen. Positions and relative intensities are assigned to orders 1–7 and 9. Some advantages of this method over the usual diffraction methods are pointed out. A.

548.73 : 535.339 3006

An adjustable curved crystal monochromator for X-ray diffraction analysis. DE WOLFF, P. M. *Appl. Sci. Res.*, **B 1** (*No.* 2) 119–26 (1948).—The logarithmic spiral form of Barraud's monochromator [*C.R. Acad. Sci., Paris*, **214**, 795 (1942)] can be obtained to a good approx. by exerting unequal bending moments on the short edges of a rectangular crystal plate. Aberration formulae relating to the asymmetrical Barraud-type monochromator are derived. A new method of mounting is described. The aberration due to its approx. character is calculated. It is negligible in the case of a monochromator described here. An advantage of the device is that there is no high precision work needed in making the crystal holder; also the monochromator can easily be set to a large range of wavelengths and crystal-to-focus distances. A.

548.73 : 537.226 3007

Crystal structure of barium titanium oxide and other double oxides of the perovskite type. MEGAW, H. D. *Trans. Faraday Soc.*, **42 A**, 224–31; *disc.*, 244 (1946).—Compounds having the empirical formula $A^{2+}B^{4+}O_3$ show distorted variants of the ideal perovskite structure

when the larger cation A^{2+} is too large or appreciably too small for the geometrical requirements of the structure, the scale being determined by the B^{4+}–O distance. When A^{2+} is too small, a monoclinic distortion of the original cubic lattice occurs, accompanied by a doubling of the cell edge, e.g. in $CaTiO_3$, $CaSnO_3$, $CaZrO_3$, and $CdTiO_3$. $BaTiO_3$ is the unique example with too large an A^{2+} ion, and abnormally large Ti–O distances; there is a tetragonal deformation, but no doubling of the cell edge; this cannot be accounted for on purely steric grounds and is attributed to a set of directed bonds of the Ti atom which are postulated to occur superimposed on the mainly ionic forces of the structure. Some observations are reported on twinning of individual crystallites during the transition, and on crystal recovery near the transition temperature. H. H. HO.

548.73 : 537.226 *see Abstr.* 2833

548.73 : 539.264 *see Abstr.* 2952–3

548.73 : 548.32 3008

The perovskite-structure family. NÁRAY-SZABÓ, I. *Publ. Univ. Tech. Sci., Budapest* (*No.* 1) 30–41 (1947).—Previous work is reviewed and powder data for 13 new members of the family, bringing the total to ~ 60. In terms of the tolerance ratio t = distance between large cation and anion divided by $\sqrt{2}\times$ the distance between small cation and anion, the following rules are proposed: If the cations are of small polarizability and t is near unity (0·98 to 1·005), the cell is cubic with $Z = 1$; if t differs appreciably from unity the cell is monoclinic with $Z = 8$. If one cation is large and highly polarizable and $t > 1{\cdot}01$, the cell is tetragonal with $Z = 1$; if $t < 1{\cdot}01$, the cell is tetragonal with Z usually 8. Similar structures with the general formula BX_3 are discussed. A. J. C. W.

548.735 3009

The accurate determination of cell dimensions from single-crystal X-ray photographs. WEISZ, O., COCHRAN, W., AND COLE, W. F. *Acta Cryst.*, **1**, 83–8 (*May*, 1948).—Determination by a graphical extrapolation method has been discussed by Farquhar and Lipson [Abstr. 1395 (1946)]. An alternative method of lower accuracy but greater simplicity is described here. An account is also given of the application of extrapolation methods, both graphical and analytical, to the determination of the cell dimensions of a monoclinic crystal, a heat-treated orthoclase felspar. Procedures for determining accurate cell dimensions of orthorhombic, monoclinic and triclinic crystals are outlined. A.

548.735 : 517.522.3 = 82 3010

Method of obtaining Bragg projections by means of rapidly converging series. KONOBRYEVSKI, S. T. *C.R. Acad. Sci. URSS*, **59** (*No.* 1) 33–5 (1948) *In Russian.*—One of the methods most frequently used in structural analysis of crystals is to project the electronic plane on a co-ordinate plane, which leads to an expansion in a trigonometrical series in terms of the angular factors, the coefficients of which are the square roots of the intensities of interference. The latter, however, cannot in general be determined from experimental data. Moreover the convergence of the series is a bad one, which does not permit of a reliable determination of the electron density. By changing over to a similar series for the potential in the crystal, related to the density by Poisson's equation, rapidly converging series are obtained which not only simplify calculations but give a satisfactory representation of the experimental results.

548.735.4 3011

The Fourier and the new point diagram synthesis in X-ray crystallography. YÜ, S. H. *Chin. J. Phys.*, **7**, 81–95 (*Dec.*, 1947).—A newly developed synthesis of X-ray data for crystal analysis, called the point diagram synthesis, is compared with the classical Fourier synthesis. The fundamental assumption in the method is explained and a correlation matrix of index 10 is given. Some mathematical properties of correlation matrices, e.g. absolute convergence and the h- and μ-summation rules are described and illustrated. The method is applied in parallel with the Fourier method to an arbitrary structure along with its two component structures. The crystal NaCl is studied, using actual experimental data. It is shown that the information given by the two types of syntheses are entirely different. A.

548.735.4 3012

The Fourier method of crystal structure analysis. COCHRAN, W. Letter in *Nature, Lond.*, **161**, 765 (*May* 15, 1948).—The relationships between the Fourier and least squares methods lead to some useful results concerning (1) reduction of the weight of Fourier coefficients, (2) termination of the Fourier series, and (3) introduction of convergence factors. L. S. G.

548.735.4 3013

A new Fourier refinement technique. BOOTH, A. D. Letter in *Nature, Lond.*, **161**, 765–6 (*May* 15, 1948).—It is shown that the standard Fourier technique may be used as a crude form of steepest descent [Abstr. 2998 (1947)] and that it is possible to obtain convergence when (1) the initial co-ordinates are very far from the true ones, (2) the synthesis fails to resolve. L. S. G.

548.735.44 3014

A critical examination of the Beevers–Lipson method of Fourier series summation. COCHRAN, W. *Acta Cryst.*, **1**, 54–6 (*May*, 1948).—The error introduced into a multi-dimensional Fourier synthesis by approximations made in the course of computation is compared with that due to random errors in the amplitudes of the Fourier components. It is shown that the Beevers–Lipson method of Fourier summation, normally employed in crystallographic work, is an entirely adequate method of calculating the electron density unless the structure amplitudes have been measured to an accuracy such that their standard deviation < 2, in the customary units. A.

548.735.44 3015

Phases of Fourier coefficients directly from crystal diffraction data. HARKER, D., AND KASPER, J. S. *Acta Cryst.*, **1**, 70–5 (*May*, 1948).—It is shown that the application of Schwartz's and Cauchy's Inequalities to the formulae for calculating F_{hkl} from, respectively, the density of scattering matter and the atomic positions in a crystal leads to relations between the magnitudes of some F_{hkl}'s and the signs or phases of others. These relations are in the form of inequalities, which vary with the symmetry of the crystal under consideration. A table of the simplest inequalities applicable to crystals possessing each of the simple symmetry elements is included. Examples of the inequalities arising from the presence of combinations of symmetry elements are presented. A.

548.735.44 3016

Structure-factor relations and phase determination. GILLIS, J. *Acta Cryst.*, **1**, 76–80 (*May*, 1948).—The method of inequalities [Abstr. 3015 (1948)] is extended and new types of inequalities are established for the structure-factors of a centro-symmetric crystal. The techniques for obtaining relations are described, and examples are given of inequalities derived by each of the various methods. A.

548.735.44 : 518.5 3017

Erratum: Remarks on some recently developed devices for summing Fourier series for crystal structure analysis.

CHRIST, C. L. *J. Appl. Phys.*, **19**, 225 (*March*, 1948).—[See Abstr. 1118 (1948).]

548.737 3018

A comparative X-ray study of foetal and adult sheep haemoglobins. KENDREW, J. C., AND PERUTZ, M. F. *Proc. Roy. Soc. A*, **194**, 376–98 (*Sept.* 2, 1948).

548.737 3019

The crystal structure of para-chlor-iodoxy benzene. ARCHER, E. M. *Acta Cryst.*, **1**, 64–9 (*May*, 1948).

548.737 3020

Periodic errors in the crystal lattices of some molecular complexes of 4 : 4′-dinitrodiphenyl. JAMES, R. W., AND SAUNDER, D. H. *Acta Cryst.*, **1**, 81–3 (*May*, 1948).—Faults in the crystal lattices of the molecular complexes were observed, apparently similar to those discussed previously [Abstr. 3371 (1947)]. The complexes of 4 : 4′-dinitrodiphenyl with 4-fluorodiphenyl and 4 : 4′-dibromodiphenyl have also been examined, but their crystal lattices show no faults. It is suggested that the interaction of dipoles and not chemical bonding is responsible for the stability of complexes of this type. A.

548.737 3021

The crystal structures of zinc and magnesium benzene sulphonates. BROOMHEAD, J. M., AND NICOL, A. D. I. *Acta Cryst.*, **1**, 88–92 (*May*, 1948).—The isomorphous crystals are monoclinic, with space group $P2_1/n$ and two molecules in a unit cell with edges $a = 22{\cdot}6$, $b = 6{\cdot}32$, $c = 6{\cdot}94$ Å, $\beta = 93°\ 36'$ (Mg compound). The signs of the structure amplitudes were fixed by comparison of corresponding reflections from the isomorphous structures, and Fourier projections along the *b* and *c* axes were used to determine the structure. Metal atoms are surrounded by regular octahedra of H_2O molecules, which are linked by H bonds to O atoms of the sulphonate group. These O atoms and a C atom of the benzene ring are joined to a S atom by bonds which make angles of ~109° with each other. The benzene ring is plane and the minimum distance between neighbouring rings $\simeq 3{\cdot}5$ Å. The position and orientation of the molecules in the structure suggest an explanation of the observed twin growth. A.

548.74 3022

Molecular arrangement in tobacco necrosis virus crystals. MARKHAM, R., SMITH, K. M., AND WYCKOFF, R. W. G. Letter in *Nature, Lond.*, **161**, 760–1 (*May* 15, 1948).

MINERALOGY 549

549.514.51 : 548.5 *see Abstr.* 2984

549.514.51 : 621.396.611.21.002.2 3023

The development of quartz crystal production. BOOTH, C. F., AND JOHNS, J. P. *J. Instn Elect. Engrs, Pt IIIA*, **94** (*No.* 16) 899–911 (1947).—An account of the mass-production technique evolved during the War. The inspection and grading of raw crystal abroad and the specification requirements are discussed. Production processes are described, with special reference to X-ray diffraction technique for the checking of cut elements, etching for surface stability and testing for activity variation. Various forms of mounting and the reconditioning of unusable crystals are also discussed. New types of crystal units are mentioned and future developments suggested. H. G. M. S.

549.623.5 : 535.347 : 548.538 = 69 *see Abstr.* 2985

549.623.5 : 621.315.613.1 3024

Electrical properties of Indian mica. III. The effect of pre-heating. MAHANTI, P. C., AND MANDAL, S. S. *Indian J. Phys.*, **22**, 7–13 (*Jan.*, 1948).—[Abstr. 2132 B (1948)].

GEOPHYSICS 55

550.312 : 531.261 3025

The determination of the masses necessary to produce a given gravitational field. BULLARD, E. C., AND COOPER, R. I. B. *Proc. Roy. Soc. A*, **194**, 332–47 (*Sept.* 2, 1948).—Two methods are described for calculating the distribution of mass at a given depth that will produce a specified gravitational field. In one the observed field is extrapolated downwards by a finite difference procedure; in the other a solution is obtained in the form of an integral which can be evaluated numerically. Tables of the quantities necessary for the practical use of the method are provided, and real and artificial examples are given. The limit to the possible depth of the masses producing an anomaly is also discussed. A.

550.383 = 4 3026

On the mechanico-magnetic effect in the interior of rotating spherical masses. Application to terrestrial magnetism. GIÃO, A. *C.R. Acad. Sci., Paris*, **226**, 645–7 (*Feb.* 23, 1948) *In French.*—Recent work [Abstr. 2696 (1948)] is extended to determine the magnetic field produced by rotation in the interior of a spherical mass. By suitable choice of a numerical coefficient, the theory gives values for the horizontal component of intensity in agreement with recent observations at small depths below the earth's surface [see Abstr. 1123 (1948)]. R. A. N.

550.383 = 4 3027

On the magnetic field in the interior of the earth. GIÃO, A. *C.R. Acad. Sci., Paris*, **226**, 1298–300 (*April* 19, 1948) *In French.*—Formulae obtained for the magnetic field of rotating bodies [Abstr. 3026 (1948)] are used to show that the horizontal component of intensity decreases, while in general the vertical component increases with depth. R. A. N.

550.837.3 3028

Interpretation of data from electrical resistivity geophysical surveys. HOUGH, J. M.; WHITEHEAD, S., AND RADLEY, W. G. Letters in *Nature, Lond.*, **161**, 812–13 (*May* 22, 1948); **162**, 187 (*July* 31, 1948).

551.311.123 : 539.374 3029

The flow of glaciers. NYE, J. F. *Nature, Lond.*, **161**, 819–21 (*May* 22, 1948).—Short report of a discussion meeting, London, April, 1948.

551.462 : 534.24 *see Abstr.* 2396

ATMOSPHERE . METEOROLOGY 551.5

551.508 3030

Meteorological instruments shown at the Physical Society's Exhibition. SCRASE, F. J. *J. Sci. Instrum. Phys. Ind.*, **25**, 185–6 (*June*, 1948).

551.509 : 551.513 *see Abstr.* 3037

551.510.535 : 621.396.11 3031

Ionosphere review: 1947. BENNINGTON, T. W. *Wireless World*, **54**, 44–7 (*Feb.*, 1948).—[Abstr. 2557 B (1948)].

551.510.535 : 621.396.11 = 3 3032

Scattering phenomena by multiple reflection between the earth and ionosphere. DIEMINGER, W. *Naturwiss.*, **34** (*No.* 3) 88 (1947) *In German.*—[Abstr. 2558 B (1948)].

551.510.535 : 621.396.11 : 538.566 *see Abstr.* 2511

551.510.535 : 621.396.9 : 523.53 *see Abstr.* 2309

551.510.535 : 621.396.91 3033

Continuous tropospheric soundings by radar. FRIEND, A. W. *Proc. Inst. Radio Engrs, N.Y.*, **36**, 501–3 (*April*, 1948).—[Abstr. 2306 B (1948)].

551.510.535 : 621.396.91 = 397 3034

A fully automatic instrument for continuous ionospheric recording. STOFFREGEN, W. *IVA*, **19** (*No.* 3) 128–34 (1948) *In Swedish.*—[Abstr. 2591 B (1948)].

551.511 3035

Rotatory flow on the surface of the earth. I. Cyclostrophic motion. DAVIES, T. V. *Phil. Mag.*, **39**, 482–91 (*June*, 1948).—The flow is supposed to consist of (1) a flow which is symmetrical and fixed with respect to a central vertical axis, and (2) a flow which is asymmetrical about this axis and varies with time; the latter is the perturbation flow. Kelvin's method is modified and a partial differential equation is derived for the perturbation pressure. This is solved in a special case, in which the conditions approx. to those holding in a cyclone. Formulae for the force components acting upon the vortex are derived. L. S. G.

551.513 : 525.624 = 4 3036

Atmospheric tides. CHAPMAN, S. *Rev. Sci., Paris*, **85**, 847–59 (*Aug.* 15, 1947) *In French.*—A critical review of the advance made on our knowledge of atmospheric tides and of the theories put forward to explain them. Reference is made to tide effects in the upper atmosphere (*E*-layer and layer of meson formation). M. D.

551.513 : 551.509 3037

Recent advances in science. Meteorology. MILES, M. K. *Sci. Progr.*, **36**, 86–101 (*Jan.*, 1948).—The structure of the tropical atmosphere; analytical and prediction methods (39 references).

551.521.11 : 628.92 3038

Duration and intensity of sunshine. III. Daily variations in intensity. BENFORD, F. *Illum. Engng, N.Y.*, **43**, 533–46 (*May*, 1948).—[Abstr. 2596 B (1948)].

551.575 = 4 3039

Precipitation studies. DADY, G. *C.R. Acad. Sci., Paris*, **225**, 1349–51 (*Dec.* 22, 1947) *In French.*—Artificial fog has been produced in a vessel by breaking a jet of water or by adiabatic expansion, and maintained under almost isothermal conditions. Observations of the tracks of drops were made by a microscope to observe growth of small drops by collisions. Similar observations were made of the fall of small drops through a layer of oil. The results only exceptionally favour the coalescence of small drops in a cloud to produce rain, but rather support Bergeron's theory that water vapour plays the predominant part in the growth of drops. R. S. R.

551.578.11 : 541.182.2 : 532.6 *see Abstr.* 2372

551.587 3044

High altitude research with V-2 rockets. KRAUSE, E. H. *Proc. Amer. Phil. Soc.*, **91**, 430–46 (*Dec.* 3, 1947).—An illustrated review (21 figs., 42 refs.) of the methods and results of investigations with rocket-borne apparatus.

551.593 : 535.43 3045

Scattered and rescattered sunlight. HAMMAD, A. *J. Opt. Soc. Amer.*, **38**, 611–16 (*July*, 1948).—Simple approximate formulae are derived for the intensity of secondary scattered (rescattered) sunlight, in a plane stratified atmosphere of uniform composition, for high solar altitudes and weakly attenuated radiations. The formulae obtained are simpler and less elaborate to evaluate than Silberstein's [Abstr. 181 (1944)]. Numerical calculations are made for the function involved and for the rescattered sunlight received at the ground from different directions. These calculations show that these approximate formulae are really adequate giving numerical values in closer agreement with the exact values than Silberstein's. A.

551.593.5 : 535.43 = 82 *see Abstr.* 2803

551.594.221 : 621.315.1.015.5 : 621.316.93 = 397 3046

Recording lightning surges on Swedish high tension transmission lines. NORINDER, H. *IVA*, **19** (*No.* 3) 101–9 (1948) *In Swedish.*—[Abstr. 2458 B (1948)].

551.594.221 : 621.316.98 : 621.317.31 = 397 3047

Measurements of current strength on lightning discharges to high Swedish factory chimneys together with some new methods of measurement for rapid recording of impulse current strengths on lightning discharge. NORINDER, H. *IVA*, **19** (*No.* 3) 110–20 (1948) *In Swedish.*—[Abstr. 2460 B (1948)].

551.594.5 = 3 3048

An explanation of the sunlit aurora. JORDAN, P. *Z. Phys.*, **118** (*Nos* 7–8) 441–2 (1941) *In German.*—An alternative to Vegard's theory (1938) of the sunlit aurora is proposed. The auroral emissions from the sunlit high atmosphere are ascribed to metastable N_2 and O_2 excited by u.v. solar radiation. D. R. B.

BIOLOGY 57/59

591.181 = 4 3045

Directional effect of applied current on the electric organ of *Electrophorus electricus*. (Preliminary note). ALBE-FESSARD, D., CHAGAS, C., COUCEIRO, A., AND FESSARD, A. *An. Acad. Brasil Cienc.*, **19** (*No.* 4) 371–3 (1947) *In French.*—The effect of applied electric current was studied on (1) the electric organ of intact *Electrophorus electricus*, (2) isolated slices of the electric organ stimulated indirectly by their nerves, and (3) small pieces of freshly isolated tissue of the electric organ stimulated directly by Ag electrodes. Current passing through the organ in the opposite direction to that produced by its own discharge reduced the amplitude of the discharge (e.g. 2–8 mA by 50%); current in the same direction facilitated the discharge. It is suggested that the autofacilitation obtained with this latter current may explain the rapid extension of the natural discharge. E. E. C.

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 6

612.84 = 3 3049

A fundamental physiological law of light perception. BEREK, M. *Z. InstrumKde*, **63**, 297–309 (*Sept.*, 1943) *In German.*—Using the experimental results of a number of investigators on the light perception ability of the human eye, the author develops a mathematical relation to express the underlying physiological law depending on the intensity of object illumination and ambient illumination, as well as on the angle of vision of the object. The relation developed gives good agreement with observations. V. W. R.

612.84 = 3 3050

Difference thresholds with constant adaptation. KÜHL A. *Z. InstrumKde*, **63**, 405–16 (*Dec.*, 1943) *In German.*—Deals with the perception threshold of light difference

of the human eye as a function of the size of visual field and ambient illumination. When an object is viewed through a telescope the light difference perceptibility of the human eye is higher when the object is brighter than the ambient illumination, than when the object is darker. This difference between the "positive" and "negative" difference threshold is found to be due to the adaptation of the human eye. A correction is given to convert observations of positive light differences to the same basis as negative ones. This correction is found to be independent of the visual field size. V. W. R.

612.84 = 3 3048

Perception limits with black discs and the positive and negative contrast threshold. SIEDENTOPF, H., AND REEGER, E. *Z. InstrumKde*, **64**, 83–6 (*April–June*, 1944) *In German.*—Describes experiments on the contrast perception threshold of the human eye using black circular discs; also on positive contrast (object brighter than surroundings) and negative contrast (object darker than surroundings). There does not seem to be a fundamental equality of positive and negative threshold values. With small objects or higher light intensities, the positive threshold values are $\sim 2\times$ the negative values. With low contrast intensities, the positive and negative threshold values are approx. equal. V. W. R.

612.84 : 535.14 3049

The two-quanta hypothesis as a general explanation for the behavior of threshold values and visual acuity for the several receptors of the human eye. BOUMAN, M. A., AND VAN DER VELDEN, H. A. *J. Opt. Soc. Amer.*, **38**, 570–81 (*July*, 1948).—It is found from extensive threshold measurements with flashes for foveal and peripheral vision that a "red cone" in the periphery probably gives rise to a light impression when two quanta are absorbed in it within a time τ. The different kinds of receptors proved to be capable of reacting in mutual dependence on each other, and the conclusion is drawn that all receptors send a nerve impulse to the nerve connection when one quantum is absorbed. A light impression will occur when a second quantum is absorbed after the first absorption within τ sec within a receptor within a distance D of the first receptor. The dependence of the visual acuity on the intensity agrees with the two-quanta theory. A.

612.84 : 535.242.62 = 82 3050

On the theory of flicker photometry. MAISEL, S. O. *C.R. Acad. Sci. URSS*, **59** (*No.* 1) 49–52 (1948) *In Russian.*—It was established by Granit that the retinae of all animals able to distinguish optical intensities contain receptors transmitting impulses of a frequency corresponding to the intensity of the light perceived to the centre of vision—in his terminology, "dominators," and three types of receptors sensible to colours, or "modulators." The maxima of sensitivity of the latter elements lie each in a different part of the visible spectrum. The sensitivity of the dominators for any one colour is equal to the sum of the sensitivities of the modulators for this colour. On all levels of operation of this visual system the frequencies of the impulses are subject to fluctuations, the greater, the lower the frequency. The magnitude of the fluctuations defines the degree of determination of the perception of any colour. These facts may be expressed by a system of simple equations in terms of impulse and fluctuation frequencies which give at least a qualitative theory of the hitherto unexplained physiological foundations of flicker photometry.

612.843.31 3051

A comparative study of five tests of color vision. CHAPANIS, A. *J. Opt. Soc. Amer.*, **38**, 626–49 (*July*, 1948).

612.85 = 5 3052

Direct proof of sound concentration in the "singular points" effect. LO SURDO, A. *Ric. Sci. Ricostruz.*, **17**, 2017–20 (*Dec.*, 1947) *In Italian.*—Quantitative experimental evidence is given in support of the author's discovery that when a sound transmitter is in contact with certain zones (singular points) on the parietal bones the bone-conducted sound is mostly concentrated in the more distant ear. It is stated that with a 600 c/s source the ratio of the intensity in the two ears is ~ 17 db, and also that closing the auditory canal with a finger increases the ear's sensitivity to bone-conducted sound by ~ 32 db. T. S. E. T.

615.849 3053

Tissue dosage in radio-isotope therapy. EVANS, R. D. *Amer. J. Roentgenol. Radium Ther.*, **58**, 754–6 (*Dec.*, 1947).—The effects of radioactive isotopes are confined to the tissues containing the isotopes and proportional to their concentration. Commonly isotope dosages are expressed in terms of equivalent roentgens, but it is desirable to express them in terms of energy, as ergs/sec. It is shown that the roentgen corresponds to $5{\cdot}24\times10^{13}$ eV of energy (about 83 ergs) per g of air. An amount of β-radiation of this value will deliver approximately the same energy per gram of tissue, this value being defined as one "roentgen-equivalent-physical." On this basis a formula is derived for the dosage rate R, which, however, requires modification, since the exciting isotope is absorbed and excreted by the tissues, a compensatory formula being derived in this respect. Total dosage in practice can only be determined by graphical and numerical enumeration of the equation. It is shown that a long-lived isotope, such as I^{131}, delivers a total dose $>$ that of a shorter-lived isotope such as I^{130}, necessitating adjustment, when the same total dosage is required. B. J. L.

617 3054

Some clinical aspects of electro-surgery. GIBSON, H. G. *Marconi Instrum.*, **1**, 5–9 (*April–May*); 25–9 (*July–Aug.*); 46–9 (*Oct.–Nov.*, 1947); 60–4 (*Jan.–Feb.*, 1948).—Electro-coagulation and electrotomy possess certain advantages over classical knife and cautery methods. Applications to dermatology, cerebral, thoracic, abdominal, genito-urinary, gynaecological and rhino-laryngological surgery, and face and neck working, etc., are covered with reference to particular diathermy equipments and electrodes. The necessary precautions are outlined. E. D. H.

GLASS . CERAMICS 666

666 : 535.345–31 *see Abstr.* 2782

666 : 539.213 = 4 *see Abstr.* 2950

666 : 539.389.3 *see Abstr.* 2960

666.115 : 539.319 *see Abstr.* 2954

METALLURGY 669

669 : 537.311.1.01 *see Abstr.* 2835

669.018 : 621.385.833 3055

An oxide replica technique for the electron microscope examination of stainless steel and high nickel alloys. MAHLA, E. M., AND NIELSEN, N. A. *J. Appl. Phys.*, **19**,

378–82 (*April*, 1948).—A method suitable for the examination of the surfaces of stainless steel, nickel, and high-nickel alloys was developed. The oxide film is produced on the metal surface by oxidation in a molten nitrate solution and is chemically stripped from the base metal by a bromine-methanol solution. Replicas of this type have been used to study deep-etched structures, preferential etch attack, and secondary phases in austenitic and ferritic stainless steel and in nickel. A.

669.018 : 541.123.3 3056

The constitution of the aluminium-rich aluminium-cobalt-iron alloys, with reference to the role of transitional elements in alloy formation. RAYNOR, G. V., AND WALDRON, M. B. *Proc. Roy. Soc. A*, **194**, 362–74 (*Sept.* 2, 1948).—The behaviour of transitional metals in Al-rich alloys is of theoretical interest. From a knowledge of the system Al–Fe–Ni it has proved possible to predict the general form of the equilibrium diagram for the Al-rich Al–Co–Ni alloys. Similar predictions may be made for the Al–Fe–Co alloys. The present paper describes the results of an examination of these alloys undertaken to test the predictions. Using micrographic and X-ray methods, isothermal sections have been established at 640, 600 and 550°C. Only the two intermetallic phases Co_2Al_9 and $FeAl_3$ have been recognized. Vertical sections across the Al-rich corner of the ternary model have been established by thermal analysis, and the fields of primary separation have been determined. Analysis of extracted primary crystals has shown that Co_2Al_9 dissolves appreciable amounts of Fe, while $FeAl_3$ dissolves a similar amount of Co. In each case the solution proceeds by atomic replacement. The results are discussed in their relation to the theoretical considerations involved, and it is shown that close analogies exist between the alloys of Al with Fe and Ni, with Fe and Co, and with Co and Ni.

PHOTOGRAPHY 77

77 3057

Photographic progress in 1947. MATTHEWS, G. E. *Photogr. J.*, **88 A**, 74–83 (*April*, 1948).—Short review (10 figs., about 80 refs.).

771.351 : 535.317.25 *see Abstr.* 2410

771.53 3058

New materials for applied photography. SPENCER, D. A. *Photogr. J.*, **88 A**, 91–4 (*April*, 1948).—Short review of progress in 1947.

771.534.2 : 541.141.12 3059

The photographic reciprocity-law failure for radiations of different wave-length. BILTZ, M., AND WEBB, J. H. *J. Opt. Soc. Amer.*, **38**, 561–9 (*July*, 1948).—A number of dye-sensitized emulsions has been studied. The curves showing the exposure, I_t, to give a certain density, d, as a function of the exposure time, t, are found to be essentially, but not always exactly, parallel if curves referring to the same density are compared. This is in agreement with previous experience. For the case of complete parallelism, a relation is derived between the slope, G, of the intensity scale H and D curves obtained with radiations of different wavelength, λ_1 and λ_2, and exposure times, t_1 and t_2: $1/G(\lambda_1, t_1) - 1/G(\lambda_2, t_1) = 1/G(\lambda_1, t_2) - 1/G(\lambda_2, t_2)$. This means that, for a given emulsion, the shapes of spectral-sensitivity curves (log exposure required to obtain a certain density as a function of wavelength) for different exposure times are identical, providing all the exposures within one spectral-sensitivity curve are of the same duration. The above equation is compared with the experimental results and found to hold within rather narrow limits. A.

771.534.553 = 4 3060

Definition and method of measuring transmission power in photographic reproduction. DU MARACHE, J. G. *C.R. Acad. Sci., Paris*, **225**, 1135–7 (*Dec.* 10, 1947) *In French.*

771.535.1 : 778.34 : 539.164.93 = 4 *see Abstr.* 2921

774 3061

Photo-engraving in 1947. CARTWRIGHT, H. M. *Photogr. J.*, **88 A**, 95–6 (*April*, 1948).—Short review of progress (about 30 refs.).

778.33 : 621.791.76 : 620.179.15 3062

The radiography of welds. BISHOP, R. F. *Trans. Inst. Mar. Engrs*, **60**, 131–9 (*June*, 1948).—[Abstr. 2361 B (1948)].

778.33 : 629.11.012 : 620.179.152 3063

Radiographic tyre testing. *Engineer, Lond.*, **185**, 614–15 (*June* 25, 1948).—[Abstr. 2362 B (1948)].

778.33.022.8 306

The blurring of X-ray images. KLASENS, H. A. *Philips Tech. Rev.*, **9** (*No.* 12) 364–9 (1947–8).—Factors governing the blurring of X-ray images by fluorescent screens are investigated. It is important that the magnitude of these factors should be expressed in the same terms as that of the geometrical and kinetic blurring. A method is described by means of which screen blurring is compared with kinetic blurring. It appears that the S-shaped curve which represents the distribution of intensity in the image of a sharp edge when using a fluorescent screen can be sufficiently characterized for this purpose by a straight line intersecting the S-curve at two points at a certain height. This method is applied for determining the screen blurring of a number of intensifying screens and viewing screens. It is also employed to find a formula for the total blurring when various kinds of blurring are combined.

778.34 : 771.535.1 : 539.164.93 = 4 *see Abstr.* 2921

778.35 : 526.918.5 306

Aerial photographic equipment and applications to reconnaissance. KATZ, A. H. *J. Opt. Soc. Amer.*, 3 604–10 (*July*, 1948).—This paper covers briefly some of the photographic equipment and applications in use by the U.S. Air Force, with emphasis on reconnaissance photography. Three main divisions of effort are defined: reconnaissance, mapping, and the dual field of photographic instrumentation and instrumentation photography. A heuristic equation is given to demonstrate the usefulness of long focus lenses, and the development of the long focus lenses, shutters, and performance tests is described. Shutterless strip cameras and moving film magazines are now in use, utilizing image motion compensation. Remarkable photographs have been made under extreme ground speed and low illumination conditions. New developments in mounts, lenses, cameras, and shutter are described, including the 100-in f:10 figure 4 camera, the 48-in f:6·3 camera featuring a novel high-speed louvre shutter, and two extremely wide-angle spherical focal plane cameras. The function of night photographic reconnaissance is discussed, and two night photographic systems described.

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Technical progress in kinematography. CRICKS, R. I. *Photogr. J.*, **88 A**, 84–6 (*April*, 1948).—Short review of progress in 1947 (19 refs.).